
a WeEkLy JOURNAL 0F PRACTICAL INFORMATION, ART, SCIENCE. MECHANICS, CHEMISTRY, ANI MANUFACTURES.


THE NEW BRIDGE OVER THE HUDSON RIVER AT

## OVER THE

We present a perspective view of the proposed New York and New Jersey railroad bridge across the Hudson River It shows also the New York approaches and the location of the grand teruinal station.
The station will be at the corner of Eighth A venue, Forty-ninth and Fifty-first Streets. The six track viaduct will run thence west to the block in Fiftieth iaduct will run thence west to the block in Fiftieth


THE NEW BRIDGE OVER THE HUDSON RIVER AT NEW YORK.

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 Selected Formule
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the destructive action of locomotive driving wheels.
The rapid acceleration of railway speed which has taken place in the last few years has developed some new problems in the design of the locomotive; or, to speak wore correctly, it has brought into prominen notice certain details of design which, in the earif
locomotives, received but little attention. A sixty-five ton locomotive at rest and a sixty five ton locomotive running over the track at eighty miles an hour are two very different things. In their action upon the steel rail and the roadbed, there is all the difference between static and dynamic forces, and this difference will increase with the increase of speed. The builders of the early locomotives understood this, no doubt, as well as we do today, but, at the speeds at which they ran their trains, the variations of wheel pressures were not so serious as to call for special attention. The pro per counterbalancing of a locomotive is, for obviou reasons, a more difficult problem than that of counterbalancing a stationary engine. The latter is bolted rigidly to a solid bed; whereas the locomotive is hund upon springs, and the whole machine is capable of violent lateral, vertical, and longitudinal oscillations. If it were possible so to arrange the weights in the driving wheels that they would exactly counterbal ance all the moving parts of the locomotive, it would be possible to construct a perfectly swooth running engine. But in the ordinary two-cylindered locomotive this cannot be done. As far as the balancing of the revolving weights is concerned, there is no trouble; but to balance the reciprocating parts, such as the crosshead, piston rod, piston, etc., so that at all point of the revolution they shall be perfectly counterbal anced, is a physical impossibility. If they are fully counterbalanced when at the half stroke and traveling at their maximum speed, there will be an excess of counterbalance at the dead centers, when they are at rest. Among the earlier builders it was a common practice to counterbalance all the reciprocating parts and, on some roads, this is still the practice, though it is more usual to counterbalance only from one-half to two-thirds of these weights. If they are all counterbalanced, there will be a hammering action set up by the excess counterbalance at the full stroke. At the downward half of the revolution, its effect on the driving wheel in which it is located will be to increase the pressure on the rail ; and on the upward half it will tend to lift the wheel and so reduce the total pres sure. So that instead of the wheel bearing upon the ail wh anen pressure, equal at all times to ing with the velocity of rotation. As the speed ining with the velocity of rotation. As the speed in-
creases, this action will become more dynamic in its effect, until a point is reached at which variation in pressure will be so great and so rapid as to set up a positive hammering action upon the rails.
When engineers first began to come in off their runs and complained that at high speed the driving wheels would occasionally lift entirely clear of the rails, the statement was received either with incredulity or ridi passage of a badly balanced engine at high speed over a piece of track left a series of regularly spaced depressions in the rail, showing that it had been bent down out of level at these points, locomotive builders began to un derstand how destructive was this action, and that a force which in its downward action could bend and give a permanent set to a 70 pound rail might conceivably exert an upward pressure greater than the load upon the wheel, and sufficient to lift it clear o the track.
A force that bends a cold steel rail to such an extent as to leave a permanent set in it is destructive to the bridges on a line. This is shown by the sudden snap ping of tie rods at the moment when an overbal anced engine is passing at high speed. These rods ar designed to be proportional in strength to the static load of the locomotive and train. The greatest con centration of load is that of the driving wheels; and there are thousands of bridges in existence which have been designed on the assumption that the static load of say from 15 to 20 tons on the drivers was the highest concentration to which they would be subjected Yet, as a matter of fact, these same bridges are liable to be subjected to the hammering action of an engin which strikes a series of blows of not less than 40 or 50 tons weight.

The evils of overbalancing may be avoided, or re duced to a minimum. in two ways-first by reducing the weight of the reciprocating parts to the lowest practicable limit, and second by counterbalancing only a part of their total weight. There is no doubt but that the weight of pistons, crossheads, and slide valves could in many cases be greatly reduced. Weight could be saved in the case of the piston by designing it in forms which allowed a minimum amount of material to be disposed to the best possible advantage fo strength, and also by making it of the highest grade of material. A great saving of weight could be made over the cast iron pistons which have been so largely of the whole of the reciprocating parts. In many
cases a total saving of thirty to forty per cent could be made on the present weight. With the weight thus reduced it would not be necessary to counterbalance for more than fifty per cent of it ; and in the case of heavy engines the percentage could be less than this. Of course, the unbalanced weight will tend to prouce a fore-and-aft oscillation ; but this weirht will be relatively so small that it will scarcely affect the wass of the engine as a whole
There is one other element, the size of the driving wheel, which greatly affects the question of balancing. For high speeds it should be made as large as is consis ent with a reasonable amount of starting power. The downward blow of the excess balance will vary, other things being equal, with the diameter of the driving wheel, and this is one of the causes, among others, which have led American designers to adopt large wheels for the latest types of high speed locomotives.

## Enlarging on Canvas.

Mrs. Allen gives in the St. Luuis and Canadian Photographer the following method of enlarging upon anvas: Wash canvas in hot water, rinse with cold, after which stretch to remove all folds. Salting soluafter
tion:


Thoroughly saturate the canvas with this, and hang in a warm roow to dry. Then sensitize with

Nitrate of silver
Citric acid.
4 parts
140 parts
Seusitizing is done same way as salting. Expose in solar camera, or in a similar camera illuminated by electric light. Develop the exposed canvas in


Use slightly warm, and about ten minutes is neces ary to bring out the picture, thoroughly washing after development. Tone same way as silver prints, with acetate of soda and gold. Fix in hyposulphit of soda.

## Slate for Houses.

Slate is too much overlooked as a material for inside decoration. It exists in many different shades. It is easy and inexpensive to quarry, and, by far the easiest tore to shape into pleasing forms. These qualities ender it the cheapest of durable materials for interio purposes, and the wonder is that so little of it is in common use. If large dealers would establish depots of standard goods made up for combination in house building in such forms as would be available to architects, its use would be indefinitely extended. Hardly a cottage of any pretensions would be built where it would not take a prominent part. If such depots were established, house builders would be enabled to see it, and appreciate its beauty and cheapness. As it see it, and appreciate its beauty and cheapness. As it
is, hardly one in five hundred knows anything of is, hardly one
either.-Stone.

## Eritish Association.

The ten presidents for the various sections of the British Association meeting in Liverpool next Septem ber have now been chosen. They are Prof. J. J. Thomson, F.R.S., Mathematical and Physical Science Section; Dr. Ludwig Mond, F.R.S., Chemistry; Mr. John E. Marr, F.R.S., Geology ; Prof. E. C. Poulton, F.R.S., Zoology ; Major Leonard Darwin, Geography the Right Hon. Leonard Courtney, M.P., Economics Sir Charles Douglas Fox, M.Inst.C.E., Mechanical Science; Mr. Arthur Evans, F.S.A., Anthropology Dr. Walter Holbrook Gaskell, F.R.S., Physiology and Pathology ; and Dr. D. H. Scott, F.R.S., Botany. Prof. Flinders Petrie, and probably Sir Andrew Noble, will deliver the evening discourses, and Prof. Fleming F.R.S., will give the lecture to workingmen.

At the Am Urban Hospital in Berlin 411 diphtheria patients were treated in 1894-90, 255 of whom were dis charged cured. Of 245 treated with serum, 28 per cent died, while among the 146 who were treated otherwise the mortality was 42 per cent; 53.2 of the serum cases were serious, 237 severe, and the rest slight. No evi effects were observed to follow the use of the serum and its effectiveness was proportionate to the earliness of its application and the strength of the first doses. The hospital authorities infer from this that it is not an infallible, but a highly valuable remedy.

The Brooklyn Institute has purchased the Berthold Neumoegen Collection of Lepidoptera, comprising 40,000 to 45,000 specimens. The institute will also secure the collection of Jacob Doll, of over 55,000 spe cimens, and will employ Mr. Doll as curator. Ed ward L. Graef will present his collection of about 20.000 The institution already owns the Calvarey collection, o that altogether the institution will have, say Nature, the most complete collection of lepidoptera in the world.

## THE SEY in MAY

During this month a splendid opportunity will be afforded for seeing the planet Mercury after sunset, an opportunity which no one should lose, because Mer cury, on account of its proximity to the sun, is difficult to catch sight of except under very favorable conditions. It will be visible in the west all the month, but will be best seen about the middle, when it is at its greatest distance from the sun. It attains its greatest eastern elongation on the 16th, when it will be seen shining between the horns of Taurus, a few degrees south of the second magnitude star, $\beta$, or El Nath. With a telescope it will then appear in the form of a half moon. Although Mercury is probably at all times an exceedingly hot world on account of its nearness to the sun, yet its orbit is so eccentric that the solar light and heat received on its surface vary to an enormous extent, being more than twice as great at one time as at another, and passing from one extreme to the other in the short space of six weeks. At the time when Mercury is most conspicuous in the sunset sky, about the middle of May, it will be passing from perihelion, a point reached on the 25th of April, toward aphelion, which will be attained on the 8th of June.
While Mercury is on exhibition as an evening star, Venus, the typical evening star when it lies eastward from the sun, will remain inconspicuous in the morning sky, gradually drawing nearer to the sun, behind which it will pass early in July. At the beginning of the wonth Venus will be in Pisces; at the end in Taurus.
Mars is a morning star, moving slowly in the course of the month from Aquarius isto Pisces, and at the
close of the month it will rise about 1 o'clock in the morning.
Jupiter, remaininy in Cancer, and slowly drawing nearer the "Beehive" cluster, will continue to be the most brilliant planet in sight throughout the month, and, in fact, throughout the early part of summer. Castor and Pollux in the Twins are so near the great planet that its presence serves to point out those famous stars to persons unfamiliar with the constella tions. Being brighter than any fixed star, Jupiter ought to be readily identified, but there is an easy way for those who possess a strong field glass or spy glass to make the identification doubly sure. Such an instrument cannot fail to show one or more of Ju piter's moons, and, in fa
Soturn, in the
Saturn, in the constellation Libra, rises early in the evening, and by 9 or 10 o'clock is in an excellent posi
tion for observation. Being in opposition to the tion for observation. Being in opposition to the sun, it is, roughly speaking, at its nearest point to the earth,
and, consequently, most favorably situated for telescopic study. The earth is not quite so far north of the plane of the rings as it was at the end of winter, but the change is not sufficient to cause the rings to appear to the ordinary observer appreciably narrower and, in fact, the whole planet, in all its dimensions, looks a trifle larger on account of its nearer approach.
Uranus is also in Libra, nearly between the fourth magnitude stars: $y$ and 2 . Coming into opposition on the 12 th, it-should be visible to the naked eye, but, in order to identify it, the observer should watch it with a field glass, and note its position from night to night in relation to small stars near it. For those who may wish to find it with the aid of a star atlas, I give its approximate right ascension and declination for the beginning, middle and end of the month: On May 1, R. A. 15 h. 22 m., Dec. S. $18^{\circ} 14^{\prime}$; on May 15, R. A. 15 h .20 m. , Dec. S. $18^{\circ} 6^{\prime}$; on May 31 , R. A. 15 h .17 m ., Dec. S. $17^{\circ} 56^{\prime}$.
Neptune is in Taurus and Mercury will be near it at the middle of May.
The new moon of May occurs on,the afternoon of the woon the aftern on therning of the 20th; full last of the April moon) on the forenoon of the 4th. The moon is in perigee on the 24th and in apogee on the 8th.

The moon's monthly calls on the planets strung along the zodiac will take place as follows: Mars on the 7th; Venus on the 11th; Mercury on the 14th; Neptune on the 14th ; Jupiter, on the 18th ; Saturn on the 25 th ; Uranus on the 25th.
A peculiarity of the starry heavens in the evenings of the month of May is that then the Galaxy, or Milky Way, lies stretched level upon the northern horizon, extending from Scorpio in the southeast around under the pole to Monoceros in west. In the city, or in any neighborhood where electric lights are clustered, of
course this phenomenon is practically invisible, but it should be easily seen on a clear moonless night in the open country, unless hidden behind nearby hills.
For the benefit of those using small telescopes I append a few phenomena of Jupiter's satellites, and
also of those five of Saturn's satellites which telescopes also of those five of Saturn's satellites which telescopes of moderate size may be expected to show.
On May 1, at 7:37 P. M., Sateliite I will enter on the edge of the disk of Jupiter, and at 8:52 P. M. its
shadow will follow it upon the disk. A little before

9:50 P. M. Satellite II will reappear from eclipse in Jupiter's shadow, and about seven minutes late
Satellite I will pass off the disk, its shadow following it off at 11:12 P. M.
On May 8, at 9:33 P. M., Satellite I will enter upon the disk, and twenty-tbree minutes later the shadow of Satellite IV, which will have been crossing the disk since late in the afternoon, will pass off. At about 10:42 P. M. Satellite III will reappear from eclipse, having passed into Jupiter's shadow soon after seven oclock in the evening. At 10:47 P. M. the shadow of Satellite I will enter upon the disk.
Ou May 15, at 9:46 P. M., Satellite II will disappear behind Jupiter, and nine minutes later Satellite II will reappear from behind the opposite edge of the planet. At 11:08 P.
In the following list the satellites of Saturn are mentioned in the order of their distance from the planet, beginning with the nearest of the five. The times are approximate: Tethys will be at its greatest eastern elongation on the 12th at 11:15 P. M., on the 14th at 8:30 P. M., on the 29th at 10:56 P. M., and on the 31st at 8:15 P. M. Dione will be at its greatest eastern elongation on the 2 d at $9: 50 \mathrm{P}$. M., and on the 13th at 8:30 P. M. Rhea will be at its greatest eastern elongation on the 14th at 8:15 P. M. and on the 23d at 8:50 P. M. Titan is so easily seen that it is hardly necessary to give its times of elongation. It will be east of the planet on the evening of the 2 d , west of it on the evening of the 10 th , and north of it on the evening of the 14th. Japetus will be near its western elongation, the position in which, owing to some peculiarity of its
surface, it is best seen, during the first week of the month. It is just at the elongation point at five o'clock on the morning of the 4th of May.

## Spontaneous Combustion.

by a. d. hiscox.
Although many of the mysterious fires attributed to spontaneous combustion may have originated in some other way, there can be no doubt, from the long record
of facts, that a large proportion of such fires are really of facts, that a large proportion of such fires are really
due to this cause. due to this cause.
The reduction of fire risks is a most important point of economy and of vital interest to many manufacturers, or others that make use of any material or stock that is liable to be made combustible by the applica tion of oil of any kind for facilitating its manufac ture. The first care is to guard against the accumu lation of such material or stock while in an oily con dition, in heaps or in contact with heating pipes, or even in iron receptacles, without providing against it accumulation of heat by its absorption of oxygen from the air. This may be done by spreading such stock so
as to secure a cooling effect from an extended air conas to secure a cooling
In the case of oily waste and rags, especially with painters' rags, one of the most dangerous of this class, when allowed to accumulate, !oily sawdust, or any vegetable or woody fiber used for cleaning machinery or the wiping up of waste oil, the only safety is found in its immediate immersion in water
Oily waste and rags holding any of the lubricating compounds so much in use in engine rooms and on locomotives are perhaps the most dangerous materials to be cared for, but when thrown into out of the way places, they readily become the originators of mys terious fires.
We have often seen the results of throwing a handful of oily waste from a locomotive upon the ties or into the grass at the roadside, which, taking fire in an hour or two, has set fire to ties or grass. Perhaps not a few wooden railroad bridges have been mysteriously set on fire in this way. Journaldrippings in flour mills
and saw mills are no doubt the cause of many mill and saw mills are no doubt the cause of many mill
fires; started by the accumulation of flour dust or fine floating sawdust upon oily surfaces around journa boxes or where the drippings fall. Dust of any kind from fiber or wood as found in cotton and jute mills, woolen mills and woodworking factories becomes in this manner a source of danger.
The increasing use of cotton seed oil, and the fact hat its properties are but little known by the users, is new source of danger, and needs great caution in ex posing it to the conditions favorable for spontaneous combustion.
Like linseed and other vegetable oils, the sprinkling of wool, jute, hemp or other fiber with cotton seed oil or the purpose of manufacture generates heat in material should never be allowed to lie in contact with steam or other heating pipes or surfaces, or to be heaped in large piles.
Sawdust should not be used for absorbing waste oil or drippings, unless it be immediately placed beyond harm by immersion in water or burning in a
Spontaneous combustion is not confined to oily mixtures alone, for water plays a most dangerous part when the proper conditions are present. Sawdust a packing in barrels and boxes becones a most dangerous element of spontaneous combustion when by ac
cident or neglect it becomes wet. Sawdust in boxes used for drying metal goods after washing is liable to take fire in a few hours. Spreading so that it may quickly dry is the only safe way of using such ma terial. Empty ice houses have been burned by the spontaneous combustion of a heap of damp sawdust left in them. The careless neglect of removing saw ast from sawmills is a fruitful source of fire. Oil or water may be in contact with the dust and air finishes he work of ignition.
The mysterious tires in ships loaded with cotton are probably due to excessive moisture reaching the inte rior of the bales, or possibly to a bale that had been xposed to rain previous to stowage. The shipmen of wet bales is a source of danger. Rags in bales on shipboard contain the elements of combustion in the coloring matter and the grease of cast-off clothing and are in a ready condition for the reaction of the moist air in a ship's hold. They not only heat, but are in a condition for spontaneous combustion from ny excess of moisture. The heating of and occasiona fires in large heaps of bituminous coal is due to moist ure or exposure to rain. Covering or forced ventila tion is the usual remedy.
Fires originating near steam or hot air pipeshave been attributed to the partial charring of the wood or fbrous dust by the heat, and its absorption of oxygen rom the air. Starch is quickly affected by the hea of steam pipes, and paper holding a starchy constitunt is known to become of the texture of punk when eft in contact with or near steam pipes, and become very susceptible to ignition
The explosive flash of the impalpable dust of coal wood, flour and starch, when lodged on the framework of factories and warehouses, is known by sad experi ence. It only needs a spark or a lightning stroke for a quick-spreading fire. The electric spark from large running belts is a dangerous element in dusty mills.
The heating of hay and grain when stored in mows n a damp condition is well known, and in a few cases has been found to be the direct cause of fire. Probably many of the mysterious barn burnings are due to spontaneous combustion. Corn and other grain stored in large warehouse bins heats to a degree that requires coustant aeration by changing its place by conveyors, or the injection and expansion of compressed air Heating soon destroys the grain, and, if continued by neglect, it becomes liable to spontaneous combustion.

## A Moving Mountain in France.

A phenomenon which, from its remarkable charac er, has attracted much attention in Europe, recently ccurred in the department of Gard, France, wher Mount Gouffre, a mass of rock 650 feet in height, sud denly gave way at its base and began moving toward Gardon River, upon the left bank of which it wa situated. The movement began on the 15th of Feb uary, and on the 23d the advance had destroyed th machinery in the pits of the Grand 'Combe Colliery and nearly a mile of the Alais Railway, and had de flected the course of the Gardon 61/2 feet. Six hundred persons were obliged to leave their homes at Grand 'Combe, and a water famine having been created, it became necessary to install an engine up stream to ump water from the river to supply the inhabitants f the mining center
On the 29th the mountain came to a standstill, bu it is believed by engineers that this state of rest will be but temporary, and that the rocky mass will resume its motion, cross the Gardon, and finally abut agains the mountain that skirts the opposite side of the river Should this occur, very important geological and topographical modifications will of course be made in the region and it will become necessary to prepare new channels for the Gardon and Gard rivers.
The cause of the accident is shown by the geologica tructure of the mountain, which consists of grit, green marl, limestone and triassic rocks resting upon a deep bed of clay. These different strata dip at considerble of an angle toward the Gardon. The mountain was therefore influenced by its own weight to follow the slope offered it by this inclined plane. The position was unstable and the danger imminent. Rain or he water of the Gardon must have infiltered and accumulated upon the stratum of impermeable clay and such infiltrations will have disintegrated certain points of support of the mountain and led to its slid ng, which was prepared for by the very arrangement of the ground. The noise made by the mass while it was moving is described as having been frightful.

The Gingerbread Tree.-The Hyphæne the haica a species of palm 25 or 30 feet in height rowing in Egypt, Abyssinia, Nubia, and Arabia, pro duces its fruits in long clusters, each of which contains from one to two hundred. These fruits are of an ir regular form, of a rich yellowish brown color, and are beautifully polished. In upper Egypt they form part of the food of the poorer classes of inhabitants, the part eaten being the fibrous, mealy husk, which tastes most exactly like gingerbread, whence the popula name of gingerbread tree in Egypt.

The Berlin Industrial Exhibition opens May 1, 1896, and in connection with it the Astronomical Observatory of Grunewald will be transferred to Treptow near Berlin. One of the features of the exhibition will be photographs of old instruments, models of telescopes, reproductions of astronomical drawings and kindred subjects. As the largest refractor hitherto erected in Germany has only been one of '18 inches aperture. it is gratifying to note that one is now being constructed baving an aperture of 28 inches.
The mounting is so arranged as to receive two objec tives, of which one is designed for direct visual, the other for spectroscopic and photographic observations. For this reason the latter will be a double objective of short focal length, 20 to 23 feet, and large aperture, $431 / 3$ inches, which for the present will be exhibited in an unfinished condition, as the means for the purchase and polishing of the enormous lenses, which have been very successfully cast by Dr. Schott, can only be raised during the exhibition. The rough disks of glass for the lenses of the telescope have been furnished by Dr. Schott and Genossen of Jena, while the polishing has been executed by Messrs. C. A. Steiuheil of Munich. The mounting of the instrument was intrusted to the Berlin Maschinenbau Anstalt C. Hoppe, "who was assisted" by the firm of G. Meissner, Borlin, in the execution of the minute mechanical portions. The other objective, on the contrary, is completed, and has an aperture of $271 / 2$ inches and a focal length of 68 feet.
Instead of the usual doue, the telescope is provided with a cylindrical protective envelope, which together with the tube is mounted on a rigid box, which can be rotated round the declination axis. The polar axis is placed in the interior of the pier; attached thereto, and therefore revolving round it, is a kind of bell, which incloses the observer's seat ; the above mentioned bos revolves with the bell round the polar axis. The observer sitsin the prolongation of the polar axis, in such a manner that his head is in the turning point of the whole telescope, so that he can easily follow its movements by slightly turning his head. The counterpoises for the tube extend at either end of the box; besides which there is attached a second bell, which serves to relieve the polar axis, and for this purpose runs on two antifriction rollers fixed to the pier.

## an improved sorting machine.

The illustration represents a machine adapted to sort into different sizes not only potatoes and other vegetables and fruit, but a great variety of different substances, the size, strength and other details of the machine being varied accordingly. A patent was recently granted for the improvement to C. G. Poulson, Jr., deceased, of Linwood, Pa., of whose estate C. G. Poulson, Sr .. is administrator. Within the box body of the machine is an inclined screening or separating table, mounted to have end motion, the table consisting of slats or bars, Iwhich are diamond-shaped in

podlson's potato sorting machine.
cross section, and wider apart at the tail than at the head of the table. Beneath the table are hoppers adapted to receive the different sized material passed through the bars at the narrower and wider spaces. The sorting table swings freely on hangers and is noved by turning a crank, on the shaft of which are cams, the table being moved against spiral springs which force the table against a buffer four times for each revolution of the crank shaft. Material shoveled into the machine at the top, as shown in the illustra-
tion, feeds automatically to the proper sized openings between the slats, when it instantly drops into the spouts, to be conveyed into bags or baskets, or any desired receptacle.

## a Safety hat for miners.

A hat designed to withstand blows of falling ma terial, such as pieces of coal, rock, etc., and which is thoroughly ventilated and fits easily on the head of the wearer, is shown in the accompanying illustration, and has been patented by James McNamara and Frederick W. Peppler, of Calumet, Mich. The shell and brim of the hat are formed of a single piece of sheet metal, and inside the shell is a lining or inner


## PEPPLER \& MCNAMARA'S MINER'S SAFETY HAT.

shell of suitable textile material, to the edge of which is attached a leather head band. The inner shell and band are somewhat smaller than the exterior shell, and air holes provide for a circulation of air. The band and inner shell are secured to the outer shell by a series of spring clips, the spring of which allows the band or lining to conform to the head. On the front of the hat is a socket plate to receive the hanger of a miner's lamp. The hat is very durable, is waterproof, will not absorb grease from candles or oil, and the lining may at any time be taken out without ripping or tearing it.

## Practical Disinfection of Rooms.

The frequency with which second and third cases of scarlet fever appear in houses that have been disinfected by the inspectors of sanitary authorities, says the Lancet, causes grave doubts as to the efficiency of the procedure usually adopted, despite its officia sanction. Stripping the walls, lime washing walls and ceilings, and scrubbing woodwork and floor boards with soap and water are indeed effectual enough, and to these when thoroughly done we are disposed to ascribe any successful results rather than to the more technical process of so-called disinfection by sulphur fumes, which is little better than a superstitious rite or incantation shorn of the religious character it had in the mind of Ulysses when he "fumisated" the halls desecrated by the massacre of his wife's suitors after removing the corpses and washing away the blood with a promptness that precluded all thought of other than moral pollution. But in the light of bacteriological experiments dry sulphurous acid fumes, whether generated by burning sulphur or carbonic sulphide, or, as has of late become the fashion, by opening cylinders of the compressed gas, are for all practical purposes useless. The gas would act as a fairly powerful germicide on articles or fabrics previously saturated with water. but its bleaching action precludes its employment in this way with colored materials, carpets, or curtains, and it is as what is caller an "aerial dis infectant" that it holds its ground in popular esteem But aerial disinfection is an absurdity; no one wants to purify the foul air, which is easily enough removed by simple ventilation. In disinfecting a room the true aim is to kill the germs contained in the dust on ledges or in the crevices between the boards, or adhering to the walls and other surfaces, and the dry gas is power less for this, which is best attained by a sublimate solution of the strength of 1 part in 1,000 , or by lime (not white) washing, provided the lime be fresh burnt and caustic; the carbonate or chalk used in whitewashing under the name of whiting, and into which lime is converted by long exposure to the air, being inert. The series of experiments on the infection and disinfection by various means of wall papers. distempers, and other wall surfaces conducted by Dr. Cron berg, under the direction of the late Prof. Uffelmann, at Rostock, showed that subsequent scrapings wer invariably and almost instantaneously sterilized by washing or spraying with the sublimate solution, and
equally so by lime wash after the lapse of twelve to equally so by lime wash after the lapse of twelve to
twenty-four hours. The danger of corrosive sublimate is, we believe, exaggerated, for the smallest fatal dose for an adult being probably three to five grains-equal to at least a quarter of a pint of the solution-accidental poisoning with the solution is practically not prob able, and is a further safeguard it might be colored with indigo or "laundry blue." Carbolic acid, which
is sold without restraint and is in universal use, is more dangerous on that account, and is, indeed, fre quently employed with suicidal intent and with fatal effects. In France, Germany, and Italy sublimate has nearly superseded all other disinfectants and its neg lect in this country is inexplicable. As to carpets, cur tains, bedding, and clothing, all that is capable of being washed should be plunged in a copper of boiling water for a quarter of an hour and such articles as would be spoiled by this treatment should be disinfected by steam.

## How to Find Negatives.

Much time is lost and patience expended in what is very often a futile search for some particular negative Perhaps an hour, or even more, is wasted by hunting through two or three hundred of one's photographic successes and failures. 'To obviate this expenditure of time, we would like to suggest a method of indexing that the writer has found very useful.
The pecuniary outlay for the necessary materials is trifling, and is covered by a few pence. Two note books, indexed, are all that one requires. The one contains a numerical, the other an alphabetical, in dex.
Empty plate boxes are used for storage purposes Every box should have a gummed label affixed upon the side of the box, each label bearing its own distinctive number. Plate boxes when filled may be kept ranged on a shelf like so many books. A system of double indexing is used.
The numbers 1, 2,3 , etc., refer to the boxes; under the alphabetical headings are found the titles or sub jects of the various pictures. A concrete example wil perhaps make my explanation more lucid.
One wishes to find a negative exposed, let us say, in Guernsey. Reference to the letter $G$ in the alphabetical index shows one that Mail-boat Approaching Guernsey $6: 30$ A. M. is stored in box 12. By adopting this method much time and temper is saved.-The British Journal Almanac.

## A DURABLE AND EFFICIENT WINDMILL

The illustration represents a windmill of substantial construction, with thoroughly braced andrigid fans or blades, and powerful gear mechanism for transmitting power from the wind wheel to a shaft from which the power may be taken. The improvement has been patented by W. McD. Rowan, of Garden City, Kansas. Secured to the timbers of the tower is a platform sup porting a hollow post having an annular flange sup porting the main gear wheel, whose hub fits over the flange and rests on ball bearings. This gear wheel has vertical and beveled teeth, the latter engaging a bevel pinion on the horizontal shaft carrying the wind wheel, the bearing of this shaft being secured to the upper end of a vertical hollow shaft projecting. down through


ROWAN'S WINDMILL.
the hollow post. A curved brace extends from this bearing to the bearing of thehinged tail or vane, which may be moved to throw the wheel out of the wind by means of a cord or cable passing over suitable guide pulleys and down through the tower. The vertical teeth on the main gear wheel mesh with a gear wheel on the upper end of a vertical shaft which has at its lower end a bevel gear meshing with a similar gear on a horizontal shaft carrying a pulley from which power may be taken in the usual way.

A BOTTLE STOPPER AND MEASURING DEVICE A valve stopper designed to prevent the refilling of a bottle after it has been emptied, and one with which the contents of the bottle may be discharged in measured quantities, is shown in the accompanying illustration. The improvement has been patented by tration. The improvement has been patented by
Coruelius E. Wyckoff, of No. 365 State Street, BrookCoruelius E. Wyckoff, of No. 365 State Street, Brook-
lyn, N. Y. Fig. 1 represents the stopper in a bottle, lyn, N. Y. Fig. 1 represents the stopper in a bottle,
the latter being in upright position ; Fig. 2 shows the the latter being in upright position ; Fig. 2 shows the
bottle inverted, its contents then filling a measuring space, and Fig. 3 shows the position of the parts as the measured quantity is being discharged. The cap piece is secured on the bottle by cementing or in other


## WYCKOFF'S BOTTLE STOPPER.

desired manner, after the bottle has been filled, the interior wall of the cap piece being substantially hemispherical, and having a contracted outlet to be fitted by a cork. About where the cap piece is fitted on the bottle is an annular groove forming a seat for an annular flange of a plate valve, on which rests a spherical body serving as a valve stopper for the inverted bottle, as shown in Fig. 2, while also allowing the plate valve to fall sufficiently away from its seat for the passage of material into the measuring device. When the bottle is tilted to the position shown in Fig. 3, the spherical body rolls to the lower side and forces the plate valve to its seat, thus preventing a further discharge of the contents of the bottle to the interior of the cap, while permitting that which is in the cap to be poured out. Where a coutinuous flow is desired from an inverted bottle, the spherical body is made with interstices or hemispherical depressions in its surface.

## ISAFJORD, ICELAND.

We present an engraving, for which we are indebted to L'lllustration, of Isafjord, Iceland, which is one of the principal seats of the whalebone industry. The scenery here is magnificent, the country presenting the appearance of the fiords of Norway and Sweden. The snow remains on the mountains until the middle of summer. Tourists have had some thrilling adventures in climbing the mountains back of the little village. The bay is capable of holding the largest navy in the world. There are three whale bone fisheries near this place.
Whalebone has become very scarce and it now commands a large price. The name whalebone, under which the baleen plates of the right whale are popularly known, is a misnomer and the trade name of whale fin is equally inaccurate Of the three kinds of whalebone which are found in commerce, that obtained from the Greenland whale, Balaenà mysticetus, is the most valuticetus, is the most valuable, and was one of the
great staples of northern countries when the whale fishery was a large industry. To prepare whalebone for the market, the blades or plates are boiled for about twelve hours till the substance is quite soft. In this state it can be cut into narrow strips or into small filaments, according


ISAFJORD ICELAND.
inflammable and that no light should be brought near it.

## A NEW BICYCLE BELL.

The illustration represents a bell for use with bicycles, the bell being rung with a continuous electric alarm effect by simply pressing on a lever on the handle bar. The improvement has been patented by Harry B. Breckwedel, of No. 315 West Forty-eighth Street, New York City. In clamps which may be readily secured to the rear braces of any bicycle is journaled a spring-pressed shaft carrying a swinging bell frame, the springs normally holding the outer end


## BRECKWEDEL'S BICYCLE BELL.

of the bell frame up from the tire, as indicated by the dotted lines. The bell frame carries, at its outer end, rubberfaced rollers adapted to engage the tire, and on the shaft to which the rollers are secured is a stud adapted to be engaged at each revolution of the rollers, by an arm projecting forward from the hammer, as shown in the small figure, a spring holding the hammer normally out of operative position. From the other end of the bell frame a fine steel wire extends through guides to a lever pivoted on the handle bar, where it may be conveniently engaged by the hand of the user. By pressing with the thumb upon this lever, the hands being in the ordinary position on the handle bar, the outer end of the bell frame is depressed and its wheels are consequently rotated by the tire of the bicycle, each revolution of the small wheels caus ing a blow to be struck upon the bell and the ringing being automatic as long as the pressure is continued

## Lantern sli

## Slides.

A method of making slides for the lantern other than in the ordinary way is described by Dwight Lathrop Elmendorf, who says that, finding the lantern slide was a very useful piece of apparatus in teaching, he cast about for some method of quickly and inexpen sively making a slide. Making a transfer one day, the might be used on glass. So he placed on a suitable glass a piece of black car bon transfer paper, a draw ing being placed on the top and traced upon the glass. When thrown upon the screen the effect was like a charcoal drawing and answered fully the ex perimenter's hopes. Un less it is desired to special ly preserve the slide, no cover glasses are necessary He points out that old plates-ordinary or for slides-may be fixed, then washed, and the designs drawn upon them for colored subjects. The method is so handy that it may be practiced before a class.-Photography.

Observations made on the pendulum of the Paris Observatory, which is kept ninety feet under ground, with a temperature that varies one-hundredth part of a degree at most during the year, show that it is not quite proof against the variations of atmospheric pressure. It makes an error of one-third of an oscillation in twelve million, and it is proposed to remedy this error.

Hajak, of Vienna, says that smokers are less liable to diphtheria and other throat diseases than nonsmokers in the ratio of one to twenty-eight, says the Medical Age. Schiff remarks that smoking should be positively forbidden in bacteriological laboratories, because it tends to hinder the development of the bacteria.
Russia was declared free from cholera on February 24 for the first time since the year 1888.
Scrumpox is a new disease to which football has given rise in England, says the Medical Record. It is a pustular eruption, coming indirectly from dirty jerseys and affecting especially the forwards in Rugby football, who have to shove in serimmages. It has been proved to be contagious. Bacterioscopic examination has shown the presence of the staphylococcus pyogenes aureus.
The work on Herr Andree's balloon is proceeding rapidly. A balloon house is to be erected in Spitzbergen. It will be octagonal in shape, 25 weters high and 37 meters broad. The walls and floors will be lined with felt at such points where the balloon will be liable to touch them. The roof will be covered with cotton cloth and the windows will be of gelatine in place of glass. The steamer on which the expedition will set out for Spitzbergen will carry about 35 tons of sulphuric acid to generate the hydrogen.
The St. Louis Observatory at St. Helier, in the island of Jersey, contains some interesting instruments. The observatory is situated on a small, open plateau, above the Jesuit College. It has a tower of
the Eiffel type, about 170 feet high; access to the top the Eiffel type, about 170 feet high; access to the top is obtained by a spiral staircase. A number of instruments at the top are connected by a cable of electric proper. Among the special features of the apparatus used is an anemorneter of special design. A T-shaped support with orientating arrangement bears on one arm an anemometer with half cylinders instead of the
usual cups, being thus made sensitive, it is claimed, to usual cups, being thus made sensitive, it is claimed, to horizontal components and horizontal currents only; while a helical fan on the other arm takes care of the vertical components. It is a curious fact, says Nature, that at this station, as at the Eiffel Tower at Paris, the diurnal variation of wind velocity shows an opposite character near the ground and at the top of the tower; in the former case the velocity reaches its maximum about midday and in the latter about mid night.
In a recent communication to the French Academy In a recent communication to the French Academy
of Sciences, says the American Shipbuilder, an explanation is given of some of the curious phenomena per taining to fog horrs. It has been found that, with acoustic signals or sirens, they are surrounded by a neutral zone, in which the sound is not heard at the sea level. This zone is more or less distant, according to the height of the siren on the coast, and it has a main width of about 8,400 feet. On the nearer side of this zone the sound is heard perfectly. But when it is traversed, the sound weakens gradually until it becomes almost imperceptible, when it increases again, and, on the zone being finally left behind, the sound resumes its full intensity. Experiments have been made with a vessel by causing it to approach and recede from a lightship in various directions in a straight line. In each course the sound was deadened almost completely in a zone whose central line was about 15,000 feet from the siren.
Some interesting experiments, by Plateau, in insect vision are recorded in the Bulletin of the Belgium Academy. In a bed of bright colored dahlias he concealed from search the highly colored rays of some of the flowers, exposing only the disk, and in a second series of experiments the disk also, but independently, either by means of colored papers or by green leaves secured in place by pins. Butterflies and bees sought these flowers with the same avidity and frequency as the fully exposed flowers in the patch, the bees particularly pushing their way by the obstacles to reach them. From this M. Plateau concludes that they are guided far more by their perception of odors than by their vision of bright and contrasted colors. In the second communication, says Psyche, Plateau gives the details of another set of experiments to determine whether a wide meshed net presents any obstacle to
the passage of a flying insect which could easily pass in flight through the interstices. He found that while such nets do not absolutely prevent passage on the wing, insects almost invariably act as if they could not distinguish the aperture, frequently ending by alighting on the net and crawling through. He rea sons that through the lack of distinct and sharp vision, the threads of the net produce the illusion of a continuous surface, seen at a distance.

Preparations are being made for an unusual kind of transatlantic trip for a party of American physicians, who intend to start about July 1. The party will be limited to one hundred. Each member must be a physician in actual practice and a graduate of av
American university. They will inspect the principa American university. They will inspect the principa health resorts of Europe. It is expected that variou
lieved that they will be received with the $g$
courtesy by prominent surgeons and physicians.
The will of Benjamin Franklin was allowed in the Probate Court of Suffolk County, at Boston, on March 26, on the petition of Mayor Quincy, as a foreign will having been probated in the Orphans' Court in Phila delphia. The probate of the will in Boston was deemed necessary in view of the legal disposition of the "Franklin Fund," which was created by the will of Benjamin Franklin, and which now amounts to several hundred thousand dollars.
The bill to provide for a director-in-chief of the sci entific bureaus of the agricultural department has been reported favorably by the Senate committee on agriculture.

## feed saving nose bag.

The illustration represents a nose or feed bag adapted to be so applied to the head of a horse that the latter will be prevented from throwing the feed out of the bag by tossing his head. The improvement has been patented by Clement E. Burbank, of No. 31 Eighth Avenue, New York City. At opposite sides of the top of the bag are pulleys through which is passed a cord to form double loops over the head of the horse, and the rear loop is connected by an extension of the cord to the check hook, so that when the horse lowers his head to reach the feed at the bottom of the bag the latter is raised slightly to bring the feed within are side extensions of somewhat triangular form, which fold over toform pockets. in the edges of which are drawstrings, as indicated by the small figure. Each cord or dra wstring passes across the interior of the feed bag at the rear and around a pulley, extensions of the cords being carried back and knotted, to be engaged by a hook secured to the breast collar of the harness When the horse tosses his head these cords are tight-


## bURbank's nose bag.

ened, drawing the pocketlike extensions in the rear o the bag close against the under side of the horse's jaw, and thus preventing any waste of feed. In taking off the feed bag, these cords are disconnected from the collar and secured around the bag itself, one of the cords passing through a loop on the front of the bag.

## Botanical Notes

The Candle Tree.-The genus Parmentiera (named after Aug. Parmentier, who did much for economic botany) embraces two American species, the fleshy, cylindrical fruit of one of which may be compared to a cucumber and that of the other to a wax candle. Indeed, in the Isthmus of Panama, the latter (P. cereifera) is termed the candle tree or Palo de Velas, be cause its fruits, often four feet long, have a striking resemblance to yellow wax candles, and a person enter ing the forests which are composed of this tree might almost fancy himself in a candle factory, for these fruits are suspended frow all the stems and older branches. They have a peculiar applelike odor, which communicates itself in some degree to the cattle fat tened upon them, but which disappears if, a few days previous to killing, the food be changed.
The Shoe-black Plant.-Hibiscus Rosa-Sinensis, a well known greenhouse plant, is a native of India, China, and other parts of Asia. In its native coun tries it is a tree of twenty or thirty feet in height, and
bears flowers that are very variable-double, single, red, purple, white or variegated, according to the par ticular variety. These flowers containaquantity of astringent juice, and when bruised rapidly turn black or deep purple. They are used by the Chinese women for dyeing their hair and eyebrows, and in Java fo blacking shoes, whence the plant is called the shoe black plant.
The Toothbrush Plant.-The genus Gouania em braces upward of twenty species of climbing shrubs most of which inhabit the forests of tropical America. The most interesting of these is the G. domingensis, common creeper in the West Indies and Brazil. In
flexible stems being chewed as an agreeable stomachic Toothbrushes are also made by cutting pieces of chaw stick to a convenient length and fraying out the ends, and a tooth powder to accompany the use of the brush is prepared by pulverizing the dried stems.
Toothpick Plants.-Ammi Visnaga, an umbelifer ous plant, is called the toothpick bishop-weed on account of the use made in Spain of the rays or stalks of the main umbel. These, after flowering, shrink and become so hard that they form convenient toothpicks. After they have fulfilled this purpose they are chewed, and are supposed to be of service in strengthening the gums. The spines of Echinocactus Visnaga are in common use among the Mexicans for the same purpose The number of these spines upon a singlefplant is something enormous. A comparatively small plant in Kew Gardens was estimated to have 17,600, and a large specimen at the same place could not have less than 51,000.
The Hand Flower Tree.-This tree, the English name of which is a literal translation of Macpalxochiquahuitl, the somewhat cumbersome name by which it was known to the Aztecs, is the sole species of the genus Cheirosteman. The arrangement of the stamens in the flower of this plant is most remarkable. They are of a bright red, and are united for about a third of their length (four inches), when they separate into five curved clawlike rays, and thus bear some resemblance to a human hand. A solitary specimen of this tree was first discovered growing near the town of Toluco, in Mexico. It was of great age and an object of veneration among the Indians, both on account of the remarkable structure of its flowers. and because they supposed no other tree of the kind existed elsewhere ; but forests of it have since been discovered near the city of Guatemala
The Sack Tree.-From a species of Antiaris (the genus which includes the celebrated upas tree) sacks are made in Western India by the following singular process. A branch is cut corresponding to the length and diameter of the sack wanted. It is soaked a little, and then beaten with clubs till the fiber separate from the wood. This done, the sack formed of the bark is turned inside out and pulled down till the wood is sawed off, with the exception of a small piece left to form the bottom of the sack. These sacks are in general use in Western India.
The Lace Bark Tree.-The tree producing the wellknown lace bark of Jamaica is called in that island by the name of Lagetto. The inner bark of this tree (the scientific name of which 'is Lagetta lintearia) consists of numerous concentric layers of fibers which interlace in all directions, and thus present a great degree of re semblance to lace. It is said that Charles II received as a present, from the governor of Jamaica, a cravat, frill and pair of ruffles made of this material, and it is to this day used for bonnets, collars and other articles of apparel by Creole ladies.
Seeds as Weights.-The beautiful black spotted scar let seeds called love pease (Abrus precatorius), which are much used for necklaces and other ornamental purposes, are employed in India as a standard of weight under the name of "rati." The weight of the famous Koh-i-noor diamond is known to have been ascertained in this way. The seeds of the carob tree (Ceratonia Silique) are said to have been the origina carat weights of the jewelers.
The Clearing Nut.-Notwithstanding the venomous nature of the species of strychnos whence the drug nux vomica is derived, the seeds of another specie (S. potatorum) are used in India for clearing muddy water. The natives never drink clear well water, i they can get pond or river water, which is almos always impure, according to circumstances. One o the seeds of the clearing nut tree is well rubbed for a
minute or two around the inside of the vessel (gener ally an unglazed earthen one) containing the water which is then left to settle. In a very short time, the impurities fall to the bottom, leaving the water clear Bitter almonds, by the way, are said to be employed for the same purpose in Egypt, and those of kola or sterculia in Sierra Leone. Dr. Pereira states that the efficacy of the clearing nuts depends upon their albu men and casein, which act as fining aget.ts, like thos employed for wine or beer.
Whisky Root.-A plant belonging to the genus Anhalonium, of the order Cactaceæ, which has long been known by the nawe of whisky root, from its effects on the system, which resemble those produced by alcoholic drinks, has recently attracted some attention as a stimulant and nerve tonic new to materia medica. The part of the plant used is what is popu larly called the " button." This is sliced by the Indians of Southern Texas, and the small pieces being chewed and the juice swallowed, the intoxicating effects follow it is said, in about the sarne time as would those of drink of whisky. The Indians sit for hours enjoying the beautiful visions of color and other manifestations caused by the intoxication. There are several species of the genus, one of which was known tothe Aztecs a peyotl, and the intoxicating effects of which are briefly described by Sahagun.-Hist. Universal de las Cosa de Nueva España.

THE NEW BRIDGE OVER THE HUDSON RIVER AT bles, but consist of a number of steel trusses carried NEW YORK.
(Continued from first page.)
that the river navigation should be unobstructed, it was deterwined by the company to attempt the bridging of the Hudson River by a mammoth suspension bridge, with a great central span of 3,254 feet
If there is one part of a bridge of greater importance than another, it is the foundations, and in the present case they are of colossal size and carried down to unusual depth. Beneath each tower there will be sunk eight steel caissons, forming in plan an oblong 85 feet by 168 feet between centers of caissons. At the outer corners of this oblong there will be four large caissons 62 feet in diameter; between them will be four 35 foot caissons. These will all be sunk to a depth of about 150 feet below the water level, until they rest upon solid rock. They will probably be sunk by the open dredsing process, such as was employed by the Union Bridge Company (the contractors for the present undertaking) in building the Hawkesbury River bridge in Australia. The caissons will be so arranged that the pneumatic process can be adopted if necessary. They will rise to within 10 feet of the water level and will be filled with concrete; above this the piers will be carried up in solid granite masonry to a height of 30 feet above water level. Upon the granite foundation will stand the eight columns of the towers, rising to a total height of 587 feet above the water level. They will be built of steel plates and angles and will be strongly tied and braced together. The river and shore legs of columns will incline inwardly and meet at about two-thirds of their height, from which point they will be carried up as a single construction, as will be seen by reference to our engraving.
Strung across the towers will be twelve steel cables each 23 inches in diameter; each cable will consist of a large number of steel wires, about $\frac{3}{16}$ inch in diameter, laid parallel and bound together with a wire wrapping. The wire composing the cables was originally intended to have an ultimate breaking strength of 180,000 pounds to the square inch, but recent improvements in the manufacture of steel wire make it likely that the engineers will be able to secure wire of the strength of 200,000 pounds to the square inch. On the New York side the cables will be carried down to anchorages which will consist of two solid masses of masonry 180 feet square and 150 feet high. On the New Jersey side they will be carried down through tunnels far into the solid rock and secured to massive plate girder anchorages. The twelve cables will be hung in parallel vertical planes, and contrary to the usual custom, they will not be "cradled." There will be four cables over each of the outside columns of the tower and two over each of the intermediate columns.
To prevent any deformation of the floor of the bridge under the action of a moving load, it will be provided with two large stiffening trusses, each of which in itself will be longer than the central span of the Brooklyn Bridge. Each truss will be 1,600 feet long, 125 feet from center to center of trusses, and 200 feet deep at the center. Their ends will be hinged where they meet at the center of the span, also where they rest upon the towers. They will be divided into 40 foot panels, and at each panel point will be a plate steel girder 7 feet deep and 144 feet long, reaching across the full width of the bridge from truss to truss.

At each panel point the trusses, girders and whole floor system will be suspended from the main cables by twelve steel wire suspenders, which will be at tached to the floor beams as follows: Two immediate ly on each side of the trusses and two at two interme diate points; there will be twelve lines of plate stringers, 5 feet deep, running through the whole length of the bridge, oue under tach rail. Above each floor beam, and high enough to give headway for the trains, will be a deep supplementary lattice work gir der, riveted at its extremities to the vertical posts o the truss. The floor beam will be suspended from this upper girder at two intermediate points of sup port.

Both top and bottom chords will be braced to resis the wind pressure; the former lightly, the latter very strongly. The trusses will be hinged at the center to allow for a lateral movement, and the wind pressure will be resisted by the enormous dead weight of the trusses and floor svstem. Under the action of the wind the trusses will move out sidewise and there by the suspenders will become inclined and will trans fer par
The
The maximum loads for which the bridge is designed are as follows: Dead load, about 40,000 pounds to the lineal foot; live load, 18,000 pounds to the lineal foot wind load, about 1,600 pounds to the lineal foot.
There will be six railroad tracks, and the bridge is to be strong enough to carry all the tracks loaded with trains from end to end, or a total live load of about 30,000 tons; the maximum strain on each cable will be about 8,300 tons, or a maximum of 100,000 tons on the whole twelve. It will be noticed that the shore

## apon independent piers.

The cables are attached rigidly, to the top of the towers, and do not, as usual, rest upon sliding saddles. The variations of strain in the towers, resulting frow the alterations of load and temperature, will be as follows: Maximum strain in the river leg will occur under full load and high temperature. Maximum strain in the shore leg will occur under full load and low emperature
It is estimated that the bridge itself will cost $\$ 25,000,000$, and the cost of the whole, bridge, ap proaches and terwinal works, will be about $\$ 60,000,000$. Should there be no legal or other obstructions, it is estimated that the work can be completed in eight years.
The design illustrated was made by the Union Bridge Company, of New York City. Our thanks are due to Mr. Charles Macdenald and Andrew Onderdonk, of this company, and Joseph Mayer, the engineer, for particulars received.

Defects in Negative.: and Their Causes. by charles l. mitchell, m.d.
So many amateurs are at a loss why certain defects occur in their negatives, and how in many cases they can be obviated, that the following summary of a few of the most prominent may perhaps be of aid to many disheartened photographer :
Fog indicates either decomposition of the emulsion (a defect common in all extremely rapid plates), acci dental exposure to light, over-exposure, or over-devel opment. If the negative is fogyy all over, excepting where covered by the rabbet of the plate holder, it indicates that the effect was produced in the camera, either by light leaking throngh some hole in the bellows, or through flange, woodwork, dark slide of plate holder, or that the plate was over-exposed, or that the sun was shining directly on the lens. If the edges covered by the rabbets are also fogged, it indicates light leaking into the dark room before development or contaminated developer, excess of alkali, or dete rioration of the plate. If the plate is partially fogged, in streaks, it indicates leakage of light at the junction of plate holder and camera, or at the edges or corners of the plate holder, or perhaps a leaky or burst corner of the plate box.
Abundant detail in the shadows, but lack of con trast, and general thinness of the negative, indicate over-exposure, too much alkali in the developer, the use of a spent developer, or using a weak developer for too short a time, or want of light and shadow in the ubject.
No detail in the shadows, with excessive contrast, in dicates too short an exposure, too great a contrast in
the lighting of the subject, or the use of a developer the lighting of the subject, or the use of a developer very strong in restrainer.
Clear shadows and weak contrast are due usually to insufficient development.
Round or oval clear spots, with sharp dark edges, are caused by air bubbles clinging to the plate during de velopment.
Pin holes and very fine clear spots are due to either dust on the plate during exposure, or (although the plate makers say not) a dirty, poorly filtered and impure emulsion. Small particles of insensitive haloid salts of silver remain in the emulsion, are not acted upon by light during the exposure, or by the developer and hence when the plate is placed in the fixing bath they dissolve out and clear a clear place in the film. Yellow staining of the film is caused by prolonged development with a developer that is either very old, nearly spent, or contains too little sulphite. Also, by fixing in an old, used up fixing bath. Where the staining occurs after the negative has been fixed and dried, and takes place gradually, it is due to insuffi ient fixing and the presence of undissolved silver salts.
Irregular lines are due to delay in entirely covering the plate, at once, with developer, thus giving it an opportunity to act longer on one part of the plate than another.
General mottling of the film is due to contact of the face of the plate with impure paper, to imperfect fixng, or to allowing the plate to remain for a long time n a pyro developer, without rocking.
Clear corners means that the lens does not fully cover the plate.
Bare places or patches of uneven density (noticed has not been films) indicates that the plate or film that while in some places a pool of it has formed, it has left other places nearly bare.-The Photographic Gleaner.

Mix the lanolin and petrolatum; add the glycerin and boroglyceride; lastly, add the extract of witch axcellent toilet with

## ©orrespondence.

## Interesting Shadow Phenomenon.

## To the Editor of the Scientific American

The composing room of this office is lighted by incandescent electric lamps, supplemented with gas jets fitted with Welsbach incandescent mantles. If either illuminant is used singly, ordinary dark shadows are cast when the light is intercepted. When the two lights are burning simultaneously, an extraordinary phenomenon is observed, viz., colored shadows, the direct electric rays casting a dark green shade and the incandescent mantle an orange drab. At the point where the shadows intersect each other the shade becomes denser and of a dark drab color, the green being completely destroyed by the orange drab rays.

Titusville, Pa.
[This seems to be a phenomenon partly of the subjective order, the shadow cast by one light being illuminated by the light of the other. The great difference in color of the two lights causes the difference in the colors of the shadows.-Ed.]

## Flash Light Powders.

To the Editor of the Scientific American :
I note that in your query and answer column of the March 28 issue of the Scientific American, you give several formulas for making photographic flash light powder. One of these is : Magnesium powder, 6 ounces; potassium chlorate, 12 ounces; antimony sul phide, 2 ounces.
I believe it will be well to call attention to the fact that mixtures of this nature, containing potassium chiorate or perchlorate, are extremely dangerous, for several reasons, and the making and handling of them must be carried on with the greatest care. Chlorate or perchlorate mixtures are, in the first place, sensi tive to friction. This danger is one which may be met with both in manufacture and use, and especially in ransportation.
In the second place, they are liable to spontaneous combustion, due to decomposition, which may set in sooner or later; and third, the explosion of these mix tures is of such a violent nature that serious accidents are most certain to obtain.
A few months ago a photographer's gallery in Chi cago was nearly demolished by the explosion of a flash light mixture in which potassium chlorate played an important part, and a few weeks later in the same city a chemist had his right hand so badly torn that it had to be amputated. This was the result of an endeavor to compound a flash light powder in which potassium chlorate was used as the oxidizing agent.
I believe your readers will appreciate this statement which will serve to caution any of them who are in clined to attempt to make any photographic flash light powder containing potassium chlorate or perchlorate. It will be well for those who are not versed in such matters to leave such mixtures alone entirely.

Samuel Rodman, Jr.

## Chicago, April 18, 1896.

## The Fastest Ship Afloat.

This is an age of record breaking; and record break ing for its own sake too. The wish to have the biggest, tallest, fastest, most costly something or other "in the world" is a far more putent factor in modern progress in the mechanical arts than we ever suspect. Unquestionably the development of the modern steam ship owes as much to the simple desire on the part of the ship builder to beat somebody eise, as does the peed of the race horse or the agility of an athlete This competition for its own sake has seized upon the builders of torpedo boats and driven them so hard that they are raising the limit for speed by leaps and bounds. It was only late last year that the Soko startled the marine world by passing the 30 knot linit -for years the goal to which the builder of swift craft had looked as a remote possibility-and yet her re cord was quickly broken by a French torpedo boat And now the palm has been transferred across th channel again and Her Majesty's ship Desperate stands as the fastest vessel in the world with a re cord of over 31 knots, or about 36 miles an hour One would think this was sufficient; but alwost be fore the little craft has had time to tie up at her dock the British Admiralty is demanding 33 knots an hour in the contracts for her successors. That is ahout 38 miles an hour; and as these builders have always reeled a knot or two more than the contract speed out of the little fliers, we may look for a spurt of 34 or 35 knots on the trial trip. That would be 40 miles an hour, or fully up to the all-day speed of an average express train!
Such a speed will not be obtained with a horse power much under 8,000. This is one-fourth the trial trip
horse power of the Lucania. The Lucania is of 13,000 horse power of the Lucania. The Lucania is of 13,000 than 300 tons displacement. So that the Cunard ship which is 43 times as big only takes 4 times as much power to drive her.

## APPARATUS FOR MEASURING THE SPEED OF PROJECTILES.*

This new instrument for the reliable measurement of very minute intervals of time was developed in some preliminary experiments at the United States Artillery School, Fortress Monroe, Va., in measuring the velocity of projectiles from the new 3.2 inch $B$. L. field rifle adopted by the army
In the course of these experiments, which we necessarily limited to two weeks' time, observations were taken at ntervals as small as 5 feet, and as many as ten consecative observations at 5 foot intervals, bepinning at the muzzle of the gun and extending to 45 feet distance, were easily obtained from a ingle shot. This instru. ment being admirably adapted for recording the passage of the projectile at a number of points of its trajectory, it was made an was made an object to study riation of the velocity of a
contained in a glass tube with plane glass ends. This and Fig. 3 shows the apparatus on the proving was selected because it is very clear and colorless and ground. Corresponding letters represent like parts in possesses the necessary rotary property to a consider- the figures.
able extent when situated in a magnetic field of force, The arc lamps, $L$ and $L^{\prime}$, are used as sources of the rotary power being in proportion to the intensity f the magnetic field.
To produce a magnetic field in the carbon bisulphide a coil of wire is wound around the glass tube and hight. $P$ is the polarizer; $T$, the transmitter tube con taining carbon bisulphide and wound with magnet wire; $\mathbf{A}$ is the analyzer, in front of which is a lens to electric is wound around the glass condense a beam of light upon the camera, C. The electric current passes through the coil. The prisms motor, M, revolves the sensitive plate in the camer The speed of the plate is obtained at the moment of fir ing by the sbadow of one prong of a tuning fork cast by a beam from the lamp, $L^{\prime}$, reflected from a mirror R, uponthe sensitive plate the tuning fork being run electrically by the cells, E. At $\mathbf{X}^{\prime}, \mathbf{X}^{2}, \mathbf{X}^{3}$, etc., placed at regularintervals from the gun are wir screens which are cut on after the other by the projec tile.

At $\mathbf{Y}^{\prime}, \mathbf{Y}^{2}, \mathbf{Y}^{s}$ etc.are placed devices for me chanically restoring the current Be fore firing, the

## 1.-ARRANGEMENT OF LABORATORY APPARATUS

projectile near the muzzle of a gun. From measurements on the negatives it is clearly evident from each that the velocity actually increases after leaving the gun, a fact which has long been suspected, but which, so far as we know, has not previously been demonstrated experimentally.
The particular form of transmitter used in these experiments depends for its action upon the use of polarized light. A sensitive photographic plate is made to rotate at a known speed in a light-tight box, and light is admitted to the plate through a narrow slit by means of a "massless" shutter, as the inventor terms it. Any material shutter would possess a certain amount of inertia, and would not admit of a practical result. By the use of a polarizer the light is admitted or shut off without the movement of any material thing.

As is well known, the most efficient polariscope consists of a pair of Nicol prisms. When the prisms are "crossed," the light is totally extinguished, as though the beam had been interrupted by an opaque body By turning the analyzer ever so little from the "crossed" position, light will pass through it, and its intensity increases until the planes of the prisms are parallel, when it again diminishes, and if one of the prisms is rotated, there will be darkness twice every revolution.

To accomplish the end that is obtained by rotating the analyzer without actually doing so a transparent medium which can rotate the plane of polarization is placed between the polarizer and analyzer, and made subject to the control of an electric current. Th medium used in these experiments was liquid carbon bisulphide, *For the infor mation here give Dr. Albert C. Cre Dre Absistant Pro fessor of Physics, Dartmouth College and Dr: George o Squier, First Lieu tenant, U. S. A., In lery School. lyzer, a current is sent through the coil on the tube causing the rotation of the plane of polarization.
This is equivalent to rotating the polarizer; hence a light now emerges from the analyzer. When the cur rent is broken the medium loses its rctary power and there is again complete darkness. This arrangemen makes an effectual shutter for the beam without mov ing any mass of matter
A view of the laboratory apparatus is shown in Fig. 1. Fig. 2 shows diagrammatically a complete ar-

## rangement of the electrical circuits and apparatus,



Fig. 2--ARRANGEMENT OF ELECTRICAL CIRCUITS.
 measuremen tities, the distance between screens, $\omega$ the angular veloci ty of the plate, and $\theta$ the an gle through which the plate revolves while the projectile passes between screens. This gives the expressions for the velocity $\mathrm{v}=\omega \frac{\mathrm{S}}{\theta}$. The angle $\theta$ upon the plate can be measured with considerable accuracy. In an average case with a distance of 40 feet betwe e n $\theta$ is $108^{\circ} 0969$.
Fig. 3.-APPARATUS FOR RECORDING THE SPEED OF PROJECTILES.
with a probable error from nine measurements of it is surmounted, attwo minutes before one is raised 0.0074 or an error of one part in 14,630 . The angular to the top, and at one o'cloek precisely the ball drops velocity $\omega$ can with proper instruments be obtained By means of an electric current frow the observatory with great accuracy.
The principal ballistic result obtained from the experiments may be said to be the locating of a maximum point in the velocity curve outside of the gun. This maximum point is, in the present experiment, at 6 or 7 maximum point is, in the present experiment, at 6 or 7
feet from the muzzle of the gun-certainly more than 5 feet and less than 10 -or about 25 calibers in front of the muzzle. The increase in velocity from the muzzle to the waximum point is large, more than 40 foo seconds. The muzzle velocity being about 1,600 feet, this increase is about 2.5 per cent of the whole. The decrease in velocity beyond the maximum point is comparatively gradual, obeying the true law of the resistance of the air, so that the projectile must travel about must travel about a hundred feet before the veloci-
ty is reduced to ty is reduced to
that which it actually had at the muzzle.
This maximum point introduces an error in the present method of -btaining muzzle velocities, in velochities, in ty is measured at ty is measured at
a distance of 100 a distance of 100
to 200 feet and reto 200 feet and re-
duced back to the duced back to the muzzle by formu-
las. The Frank-


## the royal observatory at greenwich.

lin Institute has awarded the John Scott Legacy medal and premium to Lieut. Squier and Prof. Crehore for this apparatus.*

THE ROYAL OBSERVATORY AND HOW THEY TELL THE TIME AT GREENWICH.
by dr. d. dunbar.
Greenwich, situate on the winding Thames, five miles east-southeast from London, in the Comnty of Kent, possesses a large amount of historical interest. It is the birthplace of many ilustrious persons, among them Henry the Eighth, Edward the Sixth, Queen Mary, Queen Elizabeth, and several children of James the First. But it is not of departed kings and queens we propose now to speak. nor of the social attractions of propose now to speak. nor of the social attractions of
Greenwich. It is a place of great resort, specially on a Greenwich. It is a p
bright bank holiday.
bright bank holiday.
The observatory building is familiar to every inhabitant of the town, and well known to scientific men all over the world. It stands on the spot once occupied by the tower built by Duke Humphrey. At one time the observatory was furnished with a deep well for the observation of stars in the daytime, but the great improvement in telescopes rendered this unnecessary, and it is now arched over. An apparatus has been erected on the eastern turret of the observatory for the purpose of enabling the captains of vessels leaving the river to ascertain by it the rate of their chronometers, thus obviating the necessity of applying at the observatory. It consists of a large ball of wood lined with leather, which, in order to give preliminary notice, is raised at five minutes before one P. M., half way up a pole, by which
*This apparatus is described at greater length and with additional illustrations in Supplement, No. 1054.


THE GUIDER AND PHOTOGRAPHER AT WORK.

The fixing of the standard of time depends on astronomical observations. When the sun is exactly south-on the meridian, as it is called-the hour is twelve o'clock noon. As the movement of the sun apparently fluctuates, astronomers call this apparent noon. At Green wich Observatory to the study of the sun is added that of the stars for accurately recording the time.
The way of it is this. There are two finely made clocks-the solar clock, keeping the solar time, and the sidereal clock, regulated by observations of the stars. The sidereal clock is kept as the standard, and every night or day the weather permits, any error is determined by comparison of the clocks. The error lock. The erro of the solar clock is then corrected The standard time, therefore, is kept for the nation at Greenwich by constant observation of certain stars, checked by observa ions of the sun tions of the sun. There are some two hundred and fifty stars calendared at Green wich, which are known as clock stars. The ob servations are made with a fine instrument called the transit or meridian circle. Greenwich circle the honor of hav ing been the first observatory in the world where
$\qquad$

ONE OF THE DOMES. a large transit
The observatory is an oblong edifice, divided into (circle was mounted, viz., in 1850. Briefly, it is a four apartments. It is a quiet, retired spot well walled large and fine telescope, mounted between two uparound, some 150 feet above the average height of the rights, and pointing exactly to the center line-the river. The roar of London sounds muffled and distant, and only seems to emphasize the sense of calmness and silence in this abode of science. Here, above the trees of the old park, and on the rim of tise mighty city, the astronomers keep the time for half the world. Greenwich time is the standard for the British nation, for British ships at sea, and for the ships of most other countries as well.
We were received by Mr. W. H. M. Christie, Astronomer Royal, and placed in charge of the senior computor, Mr. H. Furnel, to be escorted over the apartments. We soon find that his acquaintance with the interesting and delicate instruments that are explained in turn is much greater than our limited powers of comprehension. But Mr. Furnel, who has become a student of the stars, is a patient gentlema who goes to much trouble in his endeavors to initiate layman in the mysteries of the heavens.
The main question of this paper is how they tell the time at Greenwich, and we shall endeavor to explain this in popular rather than in scientific language:
ights, and pointing exactly to the center line-the meridian-of the heavens, as seen at Greenwich. As the telescope is so hung that it will swing round in. a complete circle between the uprights, it can view any point in this center line of the heavens. The roof of the room in which the telescope is placed can be opened by a sliding or trap door above it, and thus can expose any point of the meridian.
This center line is supposed to be drawn across the heavens from pole to pole of the earth, through the Green wich zenith ; and it is when on this center line in their journey from east to west that the sun and stars are said to be on the meridian. When the sun is on this line, the hour is midday at Green wich.
In the eyepiece of the telescope are five wires, one of which is exactly on the middle. When, therefore, the star passes this line, it is at the highest, or crossing the meridian. This, however, is not exactly the same as the actual time, because no transit telescope is pro bably exactly on the meridian line, and the error is orrected by various calculations.
Connected by electricity with the transit circle is a "chronograph," which at Greenwich is on the other side of the courtyard.

The chronograph is a cylinder on which paper is fixed, and on paper is registered the times of the stars


TAKING AN OBSERVATION.
transit across the fine lines of the telescope. It can also register the seconds of a sidereal clock. By this system of registering the transit of stars greater accuracy is gained and also greater time is permitted to the observer to gaze through the telescope.
But it may still be asked, Why are stars selected to tell the time? Because, for one very potent reason, there is but one sun, and there are so many stars; therefore, so many more chances of good observation. There are very few nights on which some of the 250 clock stars used at Greenwich are not observable. Further, the observations on the various stars may be used to check one a nother and correct errors, while but one observation of the sun on the meridian can be made.
But how can the passing of the star over the meridian tell the time? In this way: The complete turning round of the earth on its own axis causes a day and night, that is, $t$ wenty-four hours, which, in astronomical language, form one day. If, then, a certain star be on the meridian at such a time, it should be on the meridian again, after a lapse of twenty-four hours, at precisely the same time; and the clock, to bs accurate, should agree. The earth has made one complete turn round, one complete rotation, and one complete day and night have passed. This is termed a sidereal day, and it is regarded by astronomers as always of the same space of time, because the turning of the earth is regarded as exactly uniform
The solar day or solar time is measured by the pas sage of the sun day after day across the meridian, and is four minutes more than the sidereal day. Further, the solar day differs somewhat in length, through the movements of sun and earth; thus the earth moves more quickly in winter than in summer; and these differences are allowed for by astronomers in calculating time. The result is what is called "mean" time.
The reason of the difference of four minutes is that one revolution is added to the diurnal revolutions of the earth on its axis, in consequence of its revolution around the sun in its orbit, so that while there are in round numbers 365 days in the solar year, there are 366 sidereal days. The four minutes per day difference, therefore, makes in the year another whole day, that is, 24 hours 20 minutes. Four minutes saved or lost in a day, you see, make up a whole 24 hours at the end of the year.

But the keeping of the time is not the only work that is done at the observatory. There are ten great telescopes, the largest one being nearly 30 feet long, with an object glass of 28 inches. Over this is a beautiful dome, made like the others of papier mache stretched over iron framework. This gives lightuess and strength, enabling the dome to be easily worked on wheels. One portion, opened like a sliding shutter, reveals a strip of sky from the zenith to the horizon so that by turning the dome round, any part of th sky can
tion.

The large telescope is devoted to the stupendou work of photographing the heavens. About a dozen observatories are engaged in this truly gigantic task, each having a certain portion allotted to it.
All is remarkably quiet at the observatory, Green wich. Day after day and night after night the obser vations go forward and the calculations are made. About twenty computers are busily engaged in reducing by calculation the various observations that have been made

For anything I have been able to say, I am in debted to the astronomer royal and his able assist ants; also to those who like myself have visited the royal observatory at Greenwich and made notes, and by comparing notes have been assisted in reaching accuracy.

## Bacteria in Milk.*

Bacteria are plants of almost inconceivably minute size. So small are they that in some cases $50,000 \mathrm{might}$ stand side by side and the whole line only reach a length of an inch. They are extremely simple also. Some of them are simple balls, others are short cnes and others still are of a spiral shape. But although thus very small and simple in structure, their powers of multiplication are so great as to make them factors
of profound signiticance in the processes of nature. of profound signiticance in the processes of nature.
So rapidly can they multiply that in some cases a single individual in the course of twenty-four hours may produce nearly twenty million offspring. This power of multiplication is so enormous we must no be surprised to find them capable of accomplishing by their growth many great changes in nature.
Pure milk, as it is secreted from the udder of the healthy cow, contains no bacteria. If the cow b diseased, this may not be true, but the milk from th healthy cow contains no bacteria when first secreted Nevertheless, by the time the milk reaches the milk pail it will contain from 30,000 to $5,000,000$ bacteria per
cubic inch. It is hardly conceivable that the few cubic inch. It is hardly conceivable that the few taminate the wilk to this extent. We have learned in

## ous host

Part of them, a small part, come from the air ; part eve already in the milk pitil. The dairyman with washes his milk pail free from bacteria. Eve with the most thorough washing which the pails re but remain ordinary farm the bacteria are not killed in the crevices in the wood. Part of them come from the milker, for he commonly goes to the milking without any special toilet, with his hands not clean, and clothed in the ordinary farm clothes which have become filled with bacteria from numerous sources. But by far the greatest number come from the cow herself. These are not, however, from the interior of the cow, but from her exterior. First, her flanks are always covered with dirt. Frequently they are covered with layers of dried manure, and always the hair of the legs, sides, flanks and tail are covered with a large amount of dust and dirt. All of the dirt and manure is crowded with innumerable hosts of bacteria Again, the milk ducts of the cow's teats form a prolific breeding place for the bacteria. After each milking some milk is left in the milk ducts, and in this the bacteria which may get to teat from the air or the dirt or hairs of the cow find abundant food. Here they multiply, and by the time of the next milking they are present in countless millions, ready to be wash ed out with the first milk that is drawn.

From such sources, then, the milk receives its popu lation of bacteria, and these sources are sufficient to inoculate the milk to the great extent mentioned. The great remedy for them is cleanliness. Remembering that the bacteria grow rapidly after getting into the milk and begin to multiply with great rapidity, the value of the immediate application of cold to the milk is plain. The milk when drawn is in just the best possible condition for them to multiply. Immediate and rapid cooling so greatly checks the growth of bacteria as to greatly reduce the number present in the course of twenty-four hours. This is the explan ation of the fact that the milk dealer not inirequently has complaints from his patrons that his morning's wilk sours, while no such complaints are received of the milk of the night before. The latter was cooled during the night, while the former was taken to delivery at once from the cow or with insufficient cooling. For this reason it actually sours quicker than the milk of the night before, which needs to warm up before the bacteria can grow in it rapidly
If milk contained no bacteria, it would never under go any of the common changes which are common in milk, for $\cdot a l l$ of these are produced by the growth o the bacteria. But these bacteria are of many kinds, and even those that commonly get into milk are of many different species. Certainly over 100 different different species do not all produce the same effects on the milk. Some of them sour it by changing the milk sugar to lactic acid. This, as well known, is the most common effect arising in milk upon standing. but others produce other results. Some of them make the milk bitter; some curdle it, but render it alkaline or sweet to taste; others give it an unpleasant, tainted
taste; others, again, render it slimy or ropy; some turn it blue or yellow or red.
We are accustomed to think of bacteria as unmiti gated nuisances. We think of them as the causes of disease, and if, perchance, we think of them as connected with dairy matters, it is always as the cause of milk souring or some other milk trouble. But the dairyman really benefits from them more than he suf ers. Their beneficial effects are shown upon at leas wo important dairy products, butter and cheese
Every one knows that cream is seldom churned when
fresh. It is allowed to stand in a vessel or vat for a time and undergoes a process which we call ripening, or which is in some parts of the world simply called souring. During this ripening the cream acquires a pleasantly sour taste and a peculiar pleasant odor This ripening is nothing more than a fermentation due to the growth of the bacteria which are in the cream. During this twenty-four to forty-eight hour the bacteria which were in the cream multiply rapidly antil at the close of the ripening there may be as many as $2,400,000,000$ per cubic inch. This growth produce a fermentation, just as the growth of yeast in the brewery malt produces its fermentation.
The object of this ripening is at least threefold. First, it makes the cream churn more readily, and second, it gives a larger amount of butter from a given ot of cream. The third object is to give flavor to the butter. The explanation of the flavor is simple enough. While the bacteria are growing in the cream they ar producing, as they are feeding upon it, certain chemi cal changes in it. As the result of these chemical changes decomposition products are developed, and these products have various flavors and odors. If the mass becomes decayed and the flavors and tastes are decidedly unpleasant. But the first products of decomposition, instead of being unpleasant, are decidedly
cream and to the subsequent butter. After they have developed in the cream, the churning simply separates the butter already flavored with these products Thus the flavor and aroma of a tirst class butter are the gifts to the butter maker from the bacteria of the ripening period.
To make good butter, the butter maker needs not only the freedom from the species of bacteria which produce unpleasant flavors, but he needs also the presence of the species which produce the desired flavors. Butter made from cream that comes from the cleanly kept dairy may be depended upon not to de velop the unpleasant flavors which arise in butter of cream from the filthy dairy and barn.
But to insure the proper number of proper flavor producing species simple cleanliness is not so much to be depended upon. In many such cases it is true the proper flavor-producing species will be present, but not always. But why is it not possible to directly in oculate the cream with the proper flavor-producing species, just as the brewer inoculates his malt with yeast? This does, indeed, appear not only to be pos sible but perfectly feasible, and it involves the use of what are now known as starters. The starter is simply a lot of cream or milk containing a large number o bacteria, which is poured into the cream to be ripened to start the proper kind of fermentation. The start ers are of two kinds. Natural starters, which are easily made by any butter maker, and artificial start ers, which are made upon a different plan. Our bac teriologists, both of this country and Europe, have been searching for proper flavor-producing species and having found them, they propose to furnish them in quantity to the butter maker for use in his cream ripening. In the use of these starters the species of bacteria furnished by the bacteriologist is allowed to grow in a small lot of cream until its species is very abundant and then the cream is added to the large vat as a starter. The result is that the butter make can always depend upon having present a quantity f the proper flavor producing species, and can, there ore, depend with more certainty upon the product This method of using artificial starters is not new. It has been adopted in Denmark and some other coun tries of Europe to a wide extent. In this country it has been used only for about a year, and is only just coming to be recognized as a proper method of butter making. The bacteria favorable for this purpose are now upon our markets, two or three different ones be ing now used in this country. They are generally known as pure cultures, a term which simply means large quantity of one species of bacteria unmixed with others.
The bacteria are even more needed in cheese mak ing than in butter making. A fresh, flat, curdy taste s seen in fresh cheese. The cheese to be marketable wust be set aside for a few weeks to ripen, and during the ripening the flavors develop. This ripening again is simply a fermentation. It is a fermentation of a different character from that of cream ripening. It takes place more slowly and the products are of a dif ferent nature, but it is none the less due to the growth of bacteria, and the different flavors of different cheese are due to the growth of different kinds of bacteria in the cheese. But the problem has proved a difficalt one to handle, and while the general facts are easily made out and are demonstrated beyond question, very ittle in the way of practical results has as ye been reached. A future in this line can hardly be questioned.

The World's Wine Production
The Moniteur Vinicole has recently published a statement showing the wine production of the various countries of the world. From this statement it appear the yield in France amounted in the years 1895 and 1894 to $587,127,000$ gallons and $859,162,000$ gallons re pectively ; in Algeria to $83,549,000$ and $80,124,000 \mathrm{gal}$ lons; Tunis, $3,956,000$ and $3,936.000$; Italy, 469,555,000 and $539,000,000$; Spain, $379,500,000$ and $528,000,000$ Portugal, 43,890,000 and 33,000,000; Azores, Canaries and Madeira, 4, 620,000 and 2,640,000; Austria, 66, 000000 and 88,000,000; Hungary, 63.030.000 and 46,103,000; and Germany, $80,190,000$ and $110,000,000$ gallons. In Tur key and Cyprus the production last vear amounted to $52,800,000$ gallons, and this compares with an av $\epsilon$ rage yield of $40,000,000$ gallons. In Bulgaria the yield was $26,400.000$ gallons ; Servia. 17,600,000; Greece, 35,200, 000 ; Roumania, 68.640000 ; Switzerland, $27,500,000$ the United States, 89.700,000; Mexico, 1,980,000; Argen tine Republic, 29,700 000; Chile, 33,000,000; Brazil $7,700.000$; Cape of Good Hope, 2,420,000; Persia 594,000 ; and Australia, 3,300,000 gallons.

## The World's Fair Awards.

Many of our readers will be glad to know that the long expected distribution of Columbian World's Fair diplo mas and medals has begun. On April 20 a considera ble number of diplomas and medals were given to Baron Thielmann, the German ambassador, for distribution Germany. Those awarded to American exhibitor in ready for delivery in a short time. The exces sively long delay is to be deeply regretted.

## Largest and Smallest Books.

Prof. Max Muller, of Oxford, in a recent lecture, has called attention to the largest book in the world, the wonderful "Kuth Daw." It consists of 729 parts in the shape of white marble plates, covered with inscriptions, each plate built over with a temple of brick. It is found near the old priest city of Mandalay, in Burma, and this temple city of more than seven hundred pagodas virtually makes up this monster book, the religious codex of the Buddhists. In accordance with the three parts of which it is composed, generally called in a figurative sense "baskets" (pitaka), the whole is often termed "the three baskets" (tripitaka), and constitutes a library larger than the Bible and the Koran together. As the Jews figured out that the Old Testament contained 59,493 words and $2,728,100$ letters, so the Buddhist priests have computed that the "Tripitaka" contains 275,250 stanzas aud $8,808,000$ syllables. This monster book is written in Pali. Rather strange to say, it is not an ancient production, but its preparation was prompted by the Buddhistic piety of this century. It was erected in 1857 by the command of Mindomin, the second of the last kings of Burma. As the influence of the tropical climate has already marred the inscriptions, a British official, Mr. Ferrars, proposes to have these 729 plates carefully photographed, and asked that the government, or some friend of science able to do so, make provisions for this. Prof. Muller urges that this be done in order to preserve at least the pictures of this unique templecity book.
A noteworthy contrast is furnished by a recent German literary journal describing what is probably the smallest book in the world. This is a "Konversationslexikon," published in Berlin, and prepared by Daniel Sanders. The volume occupies the space of only six cubic centimeters ( 0366 cubic inch), although it is claimed to contain 175,000 words. The book must be read through a microscope especially prepared for it.Mining and Scientific Press.

## ENGLAND AND THE SOUDAN.

For the accompanying pictures of Soudanese women and warriors, reproduced from photographs by Dr. Jousseaume, we are indebted to Le Monde Illustre. The Soudan includes, in a general way, all the territory south of Nubia and the present British possessions in Egypt to the equatorial lakes, and from the Red Sea on the east to the desert on the west. It is estimated to have a population of from five to seven millions, and is ruled over by the Mahdi, whose seat of government is at Omdurman, and whose lieutenant, Osman Digna, has made frequent raids into the English territories in upper Egypt. To strengthen and possibly advance their frontier, a British expedition of some 9,000 native Egyptian troops, and a contingent of British soldiers, is now advancing up the Nile, although it is not expected that the most serious part of the campaign will begin until September or October, when the rise of the Nile will permit the carrying of supplies for the troops up the river in boats. It is said the dervishes all the time have some fifty thousand men under arms-a force which they could vastly increase without trouble, did mere numbers seem desirable. Famine, disease, the slave trade, and war among the tribes of the Soudan are re ported to be thinning out the popula. tion.
H. Moissan describes two new metallic borides, says the Comptes Rendus, ob tained at a temperature $1,200^{\circ}$ C nick $1,200^{\circ}$ C., nicke boride, NiBo and cobalt boride, CoBo Both occur in brilliant prisms several millimeters in length and are magnetic Their densities at $18^{\circ}$ are about the samenickel boride 739 ; cobalt boride, 725 The properties of the borides are analogous tothose of iron boride, and the compounds

through the frame near the handle bar. The turn table that supports the apparatus is mounted upon rollers and revolves around the pivot, so as to present to the employe in charge either an empty receptacle or the bicycle that is to be removed from the support The bicycles thus stowed away are perfectly independent, and well arranged for easy approach when pendent, and well arranged for easy approach when
the time comes for putting them off the car. An ordithe time comes for putting them off the car. An ordi-
nary baggage car is capable of receiving two of these nary baggage car is capable of receiving two of these
movable apparatus, say twenty bicycles, and yet leave movable apparatus, say twenty bicycles, and yet leave
a free space between them for two bicycles or two tandems. These apparatus may also be placed upon trucks or open cars during fine weather, when a crowd of bicyclists is anticipated upon a line on a holiday.
The same arrangewent, mounted upon an ordinary truck, will furnish the ideal vehicle for a system of bi cycle transportation aralogous to that used in large cities for the carriage of pianos. A special truckman with this apparatus will be able to deliver unpacked bicycles either to rrivate parties, on the account of railway companies or of cycle manufacturers, or to railway stations.
We do not dare to assert that the apparatus under consideration affords a complete solution of the problem of stowing away bicycles upon cars, says La Nature, but, with the present form of machines and their handle bars, we know of none more simple and practical.

## Intoxicated Wasps.

Concerning his observations of wasps which are addicted to the use of intoxicating liquors, Lawson Tait relates the following
"I have been watching the wasps with great interest and have noticed the avidity with which they attack certain fruit when fully ripe, rotting in fact, and have also noticed some of the peculiar results of their doing so. The sugar in some fruits which are most attacked by wasps has a tendency to pass into a kind or kinds of alcohol in the ordinary process of rotting a fact which is easily ascertained by the use of a still not large enough to attract the attention of the excis authorities. On such fruits, particularly grapes and certain plums, you will see wasps pushing and fight ing in numbers much larger than can be accommo dated, and you will see them get very drunk, craw away in a semi-somnolent condition, and repose in the grass for some time, till they get over the 'bout,' and then they will go at it again. It is while they ar thus affected that they do their worst stinging, both in the virulent nature of the stroke and the utterly unprovoked assaults of which they are guilty. I wa stung last year by a drunken wasp, and suffered severely from symptoms of nerve poison for several days. In such drunken peculiarities they resemble their human contemporaries."-Registered Pharma cist.

Niagara's Power Transmitted to New York.
A model of Niagara River, the power house, the town and the discharge tunnel will be exhibited at the National Electrical Exposition to be held in New York in May. The model is 12 feet by 4. The turbines will be run for a time each evening with electricity gener ated at Niagara Falls and transmitted to New York by two copper wires of the Western Union Telegraph (Company. Telephones will be connected with instruments at Ni agara, so that the roar of the falls may be heard. It is also said that some steps are being taken to deliver some of the current to condensers connected with an Atlantic cable, so that the power of Niagara way be transmitted to Europe.

Dr. Holden, of the Lick Observatory, has received the decoration of the Order of BoliOrder of Boliar (of Venezula) for his disservices to science. He has previously received the decoration of commander of the Ernestine Order of Saxony.

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## RECENTLY PATENTED INVENTIONS.

Locomotive Truck Spring Hanger. -Charles Linstrom, Vicksburg, Miss. This hanger has bars, the inner members of the forks being rigidly con nected with each other, and the forks being adapted to receive the equalizing bars. Each leaf spring extends between two equalizing bars on each side of the truck, and the seat in each hanger is at the center, so that the load is well distributed, and it is not possible to force th
springs out of their proper position by heavy shocks o ${ }^{\text {epring }}$ jars.

## Railway Appliances.

Car Coupling.-Frederick D. Cran dall, Sturgeon Bay, Wis. This invention relates to im ing thin jaws, the coupling being adapted to coupe hav tomatically with another similar coupling whether th drawheads are aligned with each other or not, while the uncoupling may be readily effected from either side the car. The improvement may also be used to coup
with cars having the ordinary link and pin coupling.

## Electrical.

Telephone Bell.-Richard D. Har and Leadvile, Col. This invention provides a simple be quick-acting after the main circuit shall have been opene or cut out, at the main office or elsewhere, and also to
ring a bell at a distance from the telephone. An auxiliry circuit is provided, which may be omitted or employed alone, the main object being to set a bell
Electric Switch.-Charles G. Bergquist, Chicago, Ill. This is a simple and compact device of a gas key, and adapted to turn the electricity on or
off as one turns a gas key. An insulated switch arm is off as one turns a gas key. An insulated switch arm is
c 9 rried by a revoluble tubular shaft, two contacts receivcqrried by a revoluble tubular shaft, two contacts receiv-
ing the $v$ ires, a ratchet wheel being attached to the tubular shaft and a pawl attached to the support engaging
the teeth of the ratchet wheel. A spherical casing is held round the switch by caps screwei into its body, a key passing into the casing screwing into the tubular shaft of the ewitch.
Electrical Hair Cutter and Nalls.-Frank M. Bell, New York City. An electriis practically utilized for cutting and singeing the bair. In a comb provided with a handle are insulated electric conductors, and there are adjustabie studs in the comb and comb handle between which is strained a wire or bar of piatinum or other refractory material, the"e being also ing the circuit. By pressing the button the circuit is completed through the wire, heating it sufficiently to burn the bair in contact with it.

## Mechanical

Sheet Metal Gage.-Elbridge G. Paull, Fairhaven, Mass. This improvement comprises a rigid or main frame part with jaw, an upright and a lever arm and a handle connected together by a spring, and pivoted within the rigid or main frame part, while a pivoted index hand is acted upon by a tappet arm, there being a circular graduated scale, and a spring throwing
the lever handlos apart. Variations in the hand pressure on the levers make no appreciable difference in the bite or pinch of the jaws, and the gage enables measures to be taken with great exactness and uniformity.

## Maldestenvins

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ames and Addrexs must accompany all letters
or no attention will be paid thereto. This is for our information and not for pubilication.
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marked or labeled.
(6841) H. De W. asks: 1. What kind of teel should be used to make a permanent magnet Please give commercial name of steel. A. Tool steel of
good quality. 2. To what degree of hardness should the steel be tempered, so that it will retain the magnetism Straw color in a clear fire. 3. What is the best mean of magnetizing the steel, to give it the; strongest mag netic effect? A. By a magnetizing coil moved from end to end 4. Will plating with gold, silver, or nickel di minish the attracting or "sticking" of the magnets? A Imost imperceptibly. 5. Would the application o mannocitin" "lessen the attracting power or adhesio Will the strength of p ermanent magnets be impaired b constant contact with the human body? A. No. 7. Do the variations of temperature have any effect upon per-
manent magnets, and if so, what? A. Increase of temperature magnets, and if so, what? A. Increase of tem-
power intensity. There is a certain amount of "trade secrets" involved in the making of is often not disclosed. Information on making perma nent magnets will be found in Scientific America Supplement, No. 318, and information on the effect of temperature on same in Scientific American, No. 4 vol. 73. Very exhaustive articles on magnetism, the construction of magnets and electro-magnets, their
physics, etc., will be found in Supplement, Nos. 7 T7, hysics, etc., will be found in Supplement, Nos. 7 , 779, 780, 781, 784, 785, 786, 187, 788 and 789 .
(6842) J. L. asks how to braze a band aw. A. Scarf the saw ends to match with a lap of $1 / 4$
nch, for small saws, up to $3 / 4$ inch, for large size. The burn. Bind together with fine iron binding wire, with he laps wet with a paste of borax and water ground on a piece of slate or rough glass. Pin the blade, laid straight, on a large piece of charcoal, ground flat, with a recess
excavated under the scarf so as to allow a blowpipe flam to pass under the saw blade. Place a piece of brass or preferably, silver solder or coin on the upper edge of he lap, with enough ground borax to flow the brazing until the solder flows, when it will draw entirely through the lap. When cold, file to an even thickness.

## INDEX OF INVENTIONS

For which Letters Patent of th
United Stater were Granted
April 21, 1896

## ND EACH BEARING THAT DATE

## (See note at end of list about copies of these patents.

 Acetophenonphenetidin, making. F. Valentiner.-Advertising chock. R. G. Wenzel
Advertising purposes, stereoscope for, H . Hari-







## icycle, G. Seyfang. J. . Warve........



 Slacking box. J. TT. Smith.
Body snield, E. Hunt.....

 Book, manifnd memorandum E. W. Biack hail.
Bock, manfoldine. W. A. Cooke. Jr.
Books, transfer sheet bolder and cover for mani


Brake. See Car brake.
Brake beam fulcrum post, H. B. Robischung
Brake handle can, J. De Moulin. ............
Brushes, manufactire of, J. Stauder....
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Burner. See Gas burner.
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