

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


$\qquad$

NEW BRIDGE AT PITTSBURGH, PA.
The engraving published herewith represents a bridge erected two years ago at Pittsburgh. The length of tho openings of 40 feet each, with roadways and sidewalks along the river's banks passing through them. It was decided by
constructed by the Iron City Bridge Works, of Pittsburgh. |through this intended street is shown. The general con The contract price was about $\$ 36,000$, whereof $\$ 12,000$ were struction of the bridge, says Engineering, to which we are indebted for the illustration, is so clearly shown by the The main arches of the bridge were fitted together in the views we give that no detailed description of it will be ne shop, but taken apart again and put together in place on cessary. We may mention, however, that Fig. 8 is a dia shop, but taken apart again and put together in place on
scaffolding. The ravine crossed by the bridge is for the

the commissioners who had charge of the work that the greater part of the year dry, and will in course of time be ribs, the rib being drawn straight instead of curved to its bridge should be calculated for a movable load of 100 lbs . $\begin{aligned} & \text { occupied by Boundary Avenue, a street of } 80 \text { feet in width, proper radius. The mode of adjusting the bearing of the }\end{aligned}$ per square foot, or $4,000 \mathrm{lbs}$., per lineal foot, with a factor $\quad$ making with Forbes street, on the center line of the bridge, $\begin{aligned} & \text { ribs on the abutments is shown by Fig. } 5 \text {. The other detail }\end{aligned}$ of safety of 5. The bridge was designed by Mr. Pfeifer, and $\left\lvert\, \begin{array}{ll}\text { an angle of about } 60^{\circ} \text {. In the elevation, Fig. 1, a section } & \text { figures will explain themselves }\end{array}\right.$


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The scientific American Supplement



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## THE MOON'S ATMOSPHERE

The moon has no atmosphere, the text books tell us: or i any, it is comparable in density only to the best vacuum to be obtained in the receiver of an air pump. Bessel estimated the greatest surface density possible in a lunar atmosphere, consistent with lunar phenomena, to be the thousandth par of that of the earth's atmosphere; and most writers on as tronomy have accepted his conclusion as final.
But it has been found that the calculations which led Bes sel to this result were vitiated by serious errors and omis sions. He failed in the first instance to take account of the difference in the force of gravity on the moon and on the earth. Allowance being made for that, it appears that the surface density of the moon's atmosphere may be three times what Bessel made it. He also overlooked the influence of temperature. Making the necessary correction for this ele ment, his equation shows that, so far from being limited to a density a thousand times less than that of the earth's at mosphere, the moon's atmosphere may be five times as dense or one two-hundredth that of our air. In view of the di minutive mass of the moon and the feeble action of gravity upon its surface, such an atmosphere would be relativel quite as important, quite as effective in its influence on the surface, as the earth's atmosphere is.
Taking the earth as unity, the diameter of the moon is less than two sevenths; its surface area, one thirteenth; its volume, one forty-ninth; its mass, a little more than one
eightieth; its mean density about three fifths; and the the force of gravity on its surface rather less than one sixth.
Spread over a surface relatively so much greater than the arth's (as $\frac{1}{13}$ to $\frac{1}{81}$ ) and acted on so slightly by gravity, proportionately as ample as the earth's at first to have been proportionately as ample as the earth's at first, and the con-
ditions to have remained similar-would necessarily occupy ditions to have remained similar-would necessarily occupy
a very much greater comparative volume than the earth's atmosphere, while its surface density would be not more than one fiftieth part as great.
But this maximum density possible under Bessel's esti mates must greatly exceed the density actually possible at the present time, since the absorption of the moon's atmosphere by the moon's surface must have gone on much mor rapidly than the corresponding absorption by the
surface exposed being relatively six times greater.
Think what enormous volumes of carbonic acid gas, oxy gen, hydrogen, and so on, have been withdrawn from the earth's atmosphere, to enter into solid combination in the coals, limestones, granites, and minerals of every sort; and try to realize what the condition of atmosphere would hav been had it been subjected to the absorbing action of a simi lar surface six times more extensive. Such,relatively, have been the conditions prevailing in the moon. If correspond ingly reduced, its atmospheric envelope is not likely now to have surface density more than one three hundredth par of that of the earth's atmosphere.
The question therefore is whether astronomers have been able to detect positive evidence of a lunar atmosphere, not like the earth's, which we have no reason to expect, but of there.
In his recent able and authoritative treatise on the moon Neison remarks that all astronomers who have devoted much time and attention to the detailed examination of the lunar surface have recognized more or less direct indication of a rare lunar atmosphere, besides the more indirect evi dence afforded by the known conditions of the moon's sur face and the phenomena presented by it. Again, with re ference to Bessel's estimate of its density, he says: "But this opinion was coincided in by none of those astronomer to whom is due our knowledge of the condition of the moon and they recognized that the lunar atmosphere seemed to possess a greater density than the theoretical considerations would appear to permit."
We have seen that those theoretical considerations rightly interpreted, are in accordance with the existence of a lunar atmosphere, very far from being insignificant; and it re simply to examine the evidence borne by observable phenomena
The only methods sufficiently delicate to detect unmistaka bly a lunar atmosphere, having a surface density less than one hundredth that of the earth's, are those based on the re fraction of a ray of light traversing it; and of these the most trustworthy is that based on the observed times of lunar occultations, that is, the cutting off the light of a star by the moon coming between us and it. If the moon had no atmosphere, the disappearance of the star should coincide exactly with the calculated time. With an atmosphere of appreciable density, the disappearance of the star must be delayed by refraction. The difference between the observed and the calculated time of an occultation would, therefore furnish a measure of the density of the lunar atm
Unfortunately this requires the moon
ractly limits limits, owing to the disturbing effect of irradiation. As the result of some hundreds of recent observations with power
ful instruments, however, occultations appear to be retarded ful instruments, however, occultations appear to be retarded
from five to ten seconds more than can be accounted for by from five to ten seconds more than can be accounted for by
the effects of irradiation. Consequently the existence of lunar atmosphere sufficiently dense to produce the differ ence found is not only possible, but very probable, consid ering the consistent nature of the results obtained by observations and the apparent inadequacy of other causes to explain them. The maximum surface density of about one two-hundredth of that of the earth; but this re
sult must be considered as merely probable, the exact densi ty being unobtainable with the observations at present ex isting, owing, as already noticed, to the uncertainty as to the moon's exact diameter.
Among the appearances which are regarded by students of the moon's phenomena as proofs positive of a lunar atmos phere of considerable density, we may mention the twiligh at the cusps of the moon, the dimness and obscurity ob served at times in certain localities while surrounding ob jects stand out sharp and clear, the blue, transient fringe to crater walls at sunrise, the local and quickly disappear ing gray border to the black shadow of some of the deep crater formations, the misty appearances within deep crater at sunrise, and the blotting-out of surface details by mists which vanish as the sun rises
After reviewing at length the evidence of these and other lunar phenomena, Neison decides that the existence of an atmosphere to the moon must be regarded as certain; the only uncertainty that remains is with respect to its density, which he is persuaded must in all probability lie between hree and four hundredths of that of the earth's atmosphere It "is therefore capable of exerting almost as powerful an effect upon the surface as the earth's,and, proportionately to the mass of the moon, is not much inferior in amount.'

THE RECENT WORKING MEN'S DEMONSTRATIONS.
In this city, in Philadelphia, in Newark, and in many other of the large populous centers, the abnormal spectacle is now being witnessed of working men banding together and marching in procession to demand of the authorities an op portunity to earn an honest living. It is impossible not to feel the greatest commiseration and concern for men re duced to this predicament, and it would be uncharitable not to find in the circumstance every condonation for errors of judgment. We are well aware that it is like offering stones, when bread is asked, to answer appeals for immediate help by indisputable maxims of political economy; but on the other hand, the working men have nothing to gain by closing their eyes to the truth, however distasteful or unfortunate the same may be, and there is something still to lose by thei pursuing a course which can in no wise enure to their benefit A moment's consideration must show to every intelligent workman that his is in reality neither an especially oppressed nor yet a privileged class of society. If he will remember that the terrible financial stress of the last three years has affected everyone, that great business houses, believed to be superior to all possible vicissitudes of fortune, have been utterly annihilated, greatenterprises, apparently in the full tide of success, have been arrested, that we have experienced not a sudden panic, from which recovery was possible, but a slow yet inevitable shrinkage of value in all things, he wil perceive that by no combination of circumstances could he and his fellow laborers be made an exception to the genera misfortune. When employers barely have the means to keep their business in existence, and then are thankful that their affairs are no worse, when, as must be the case, every penny is considered more closely than dollars were before, when people cannot hire men to do work, simply because they have neither the money to pay for it nor any way of disposing of the results of labor, it certainly cannot be expected that work can go on. Nor is there any sudden and rapid method of forcing the same into existence.
There is no greater mistake than to suppose that govern ment can do this. The governing power is not paternal here as in France or Russia. No one would more quickly resen its interference with his private affairs than would the work ing citizen himself. The particular persons whom we cal President, or Mayor, or Governor, or Aldermen, who man age, for brief periods, the mechanical proceeding incident to government, are but paid servants of the public, not rulers and for the working men or any other class of sovereign citi zens to ask, of those whom they hire to do certain work, an exercise of power without the duties and powers which they themselv
sensible.
Again, it would not be just that one part of the population Again, it would not be just that one part of the population,
because it earns a living by daily physical labor, should be provided for to the exclusion of every other class. The em ployer who may be laboring at his desk until his bodily powers threaten to succumb, in order to avert impending ruin, has an equal right to assistance. The butcher, th grocer, all the retail trades' people, who are dependent on the working man's custom for their living, would be equally justified in asking help because the working men now buy less of their commodities, It is clear that, if the State had power to make work, that work would have to be paid for by the people, through taxation; and when the working man came to spend his earnings, he would find that they would buy just so much less meat and coal in proportion a the dealers, through their increased taxatiol, have been compelled to raise the prices.
It seems to us that the only sensible course at hand is fo he men to bear their misfortunes patiently, to oe vigilant nd when any honest labor, no matter what, does appear, $t$ ake it and be content with any wages that will afford sup port. We say plainly that the present is no time for strike uch as the 'longshoremen and stone cutters have been mak ing, no matter what the pretext, and that the period is stil less propitious for enforcing dicta of trade societies or the unwritten laws of trade etiquette. We bolieve there is a deep-felt sympathy for the working men pervading the com munity, and that there is a growing tendency to afford em ployment whenever it can possibly be done. It remains for the men who join in processions and other demonstrations see to it that no hasty or ill advised action, on their part mpairs this favourable public sentiment.

## Is ANYBODY SANE?

That is to say: Is anybody so happily constituted that there is no corner of his mental organization in which he is prepared to admit, consciously or uncousciously, that some how or somewhere the impossible may happen ?
For our part we are inclined to think that perfect sanity like perfect health, is a condition impossible in the present stage of human development. It is our misfortune as well as our advantage that we are heirs of all the ages. The past remains with us; so that every man carries more or less of the imperfection, the lower life, of all the long series of life forms. reaching back to the beginning.
Without going the length of the litanies and saying there is no health in us, we are nevertheless compelled by every day experience to admit that the best of men fall far short of that state of perfect healthfulness in mind and body which we can readily conceive to be possible, and to which the human race may sometime attain. The best of men inherit physical and mental weaknesses-more correctly, or ganic imprrfections-from ancestors near and remote, which
show themselves not only in the outer form but also in the show themselves not only in the outer form but also in the inner constitution, in mental and moral traits as well as in bodily habits and diseases. In like manner man in the aggregate, that is, society, inherits creeds, customs, conditions, and surroundings, which tend powerfully to thwart the normal development of the individual.
For this reason, in the progress of nations, insanities in thought and action have not merely to be overthrown by what is right and true, but slowly outlived and eliminated from the constitution of the race by a long process of natural or artificial suppression. And often the foremost men of a nation have quite forgotten an outgrown error, a once prevalent vicious habit of thought or phase of epidemic nsanity, long before it has entirely vanished-literally died out-among the masses. Not unfrequently, too, some seemingly trivial occurrence will start an astounding revival of the long quiescent evil, - causing it to burst forth like a mental plague to ravage nations supposed to be beyond its contagion.
The recent wide-spread development of the delusions covered by the general term spiritualism is an instance in point. It is a revival of witchcraft and devilmongering, characterized by many of the obliquities and intellectual vagaries of rampant insanity. Men smitten with the disease cease to be amenable to reason in all matters connected with spiritualistic delusions. The most patent and ridiculous of frauds and follies, reputedly involving spirits and their mediums, are accepted by them with religious enthusiasm. They glory in their shame, proud to be fools in so sublime a cause. In all other fields of thought they may be shrewd, sensible, and logical to a degree; in this, the plainest de monstrations of the unreasonableness of their views, the most palpable proof of the dishonesty of their trusted " mediums," glance off from their minds like raindrops from a duck's back, making absolutely no impression.
The most amazing feature of the case, regarded otherwise
than as a phase of insanity, is the prevalence of the deluthan as a phase of insanity, is the prevalence of the delusion among the intelligent and well-to-do. No grade of society is exempt, though it runs more or less in streaks; and no amount of rebuff or exposure seems to lessen the vi
The numerous and curiously varied clientage of Flint, the swindling tea kettle medium, affords abundant illustration. swinding tea kettle medium, affords abundant illustration. A clumsy and illiterate humbug pretends to answer, under
spirit guidance, sealed letters (unaddressed, though directed within to the spirits of the dead), returning in each case the desired reply properly signed, with the letter of inquiry un opened, all for two dollars: and straightway men and wo men, of every rank in life, flood his office with banknotes and queries, in confident expectation that their departed friends and relatives will make them wise before their time.

From the newly appointed minister to England, who wants an improved family tree to give him something more than official rank at the Court of St. James, down to the gushing miss of doubtful virtue, who expects to be a medium and wants to know whether she will "wright impressnoley or makonakley," the whole lot of them seem to be on the sam level of intellectual imbecility the moment they enter the
spiritualistic sphere: a level so low that the medium's silly rant and senseless doggerel seem to each and all to be the natural talk of dead statesmen and dead fools alike.
No doubt some of them, now that their silliness has bee been exposed by the medium's letter book, feel somewhat as the swindler did when he said to the reporter in jail: "I feel as if I should love to get out of here and fly!" Even the Honorable Mr. Pierrepont mustfeel a littJe like flying when he sees his correspondence with "My dear Lady Mary" in print, and has to face the chaffing he so richly deserves. But will his faith in spirit communications, or the faith of any of them, be shaken in the least? We very much doubt it To sane people the conviction of ninety-nine people out of every hundred mediums as pitiful tricksters and knaves is presumptive evidence that the unexposed hundredth is no better, but not so with the faithful. With them it is not matter of experience or judgment, but a pure delusion which no dishonesty on the part of mediums can stagger The venerable and credulnus seeker for aristocratic connec-
tions did not slacken his pursuit in the least when the dis gusted female Flint told him the secret of the tea kettle What if the letters were opened and copied? What if the medium were a beggarly fraud? Could not the spirit of "My dear Lady Mary" make use of him all the same?
A few days ago a poor lunatic, in great agony of spirit poured into our ear a pitiful tale of impossible ancestry poured into our ear a pitiful tale of impos
"But," we objected, "all this seems to hinge on the con "But," we objected, "all this seems to hin
" To be sure!" he replied, with insane vehemence, " to be sure ; but, you know, in my clairvoyant state conjecture to $m e$ has all the force of demonstration!"
That is precisely the mental condition of most spiritual sts touching matters spiritualistic. Their conjectures abou spirit life and spirit action have to them all the force of de monstration. In other fields of thought and action, they may be as sane as our unhappy friend was except where his paternity was involved; but in this field they are blindly ir rational, incompetent alike of reasoning or of feeling the force of the reasoning of others.
But-more's the pity!-spiritualists are not the only people who lead a double life, sane on one side, insane on the other, taking conjectures for what they are worth in most fields of thought, but exalting conjecture above a things else in some special field. The world is full of peopl who, with more or less enthusiasm, expect the impossible to happen somewhere. A fraudulent motor violates the plain est principles of science: therefore they believe in it. dogma runs counter to all experience: therefore it must be
divinely true. "I cannot comprehend : therefore I believe," is their ideal of spiritual exaltation ; and too often they are ready to assign to a protracted and disagreeable future all such as cannot share their particular insanity
The disease, more or less virulent, is indeed all but uni ersal. ${ }^{\text {c }}$ When it involves matters of every-day real impo tance, we seclude the victims and subject them to medical treatment ; when it deals wholly with the unreal, we-well, sometimes we call them philosophers and sometimes we canonize them ; but it is the same disease, with varying inten sity, throughout. The man who sees snakes in the air is sick; he who beholds angels is supremely blest!
Is there any cure? We are happy to believe there is: in ime, and the slow development of the race toward perfect sanity. For untold millenniums the human race has been stumbling upward through intellectual infancy, acquiring much and forgetting much. By degrees men are learning to distinguish the real from the imaginary, to abide more and more by reason and sound experience, putting less and less faith in conjectures. Ultimately men may develope into a race purely rational, capable not only of habitually drawing right conclusions from correct premises, but of always re fraining from positive judgment until the premises have been fully established and properly verified: a race constibeen fully estabally sane.
tutionall
But progress in that direction cannot be very rapid until men have ceased, in each and every department of thought, to make a virtue of insanity : in other words, have ceased to set faith in the unverified and inconceivable above every other faculty, studiously training the young to be irrational. Not until the current methods in education are exchanged for more wholesome and rational methods, not until men have learnt at all times and in all connections to treat conjectures as conjectures-pleasant to think about sometimes, and some times very useful as aids and inspirations in the pursuit o knowledge and the development of character, but never to be mistaken for truth or rated as a superior kind of truththen, and not till then, will the race cease to be liable at all
times to outbreaks of epidemic insanity. Then, and not till then, will it be impossible for swindles of the Flint and Mummler and Katie King and Keely motor order to flourish outside of insane asylums.

## HOW TALL ARE WE?

In discussing the results of the tables of measurement of drafted and enlisted men, prepared from the records of th Provost Marshal General's Bureau, made during the late war Dr. Baxter remarks that probably no question of anthropol ogy has been more debated and none left in a more unsatis factory condition than that of the mean stature of the full grown man. The reason for this he finds principally in the confused mannerin which measurements have been prepare or the purpose. "Hights of young and old, of men of wide militia, of men and women, of students under the age of full militia, of men and women, of students under the age of full
growth; of convicts, a class generally below the mean hight of their countrymen; of men measured in shoes and men measured without shoes, have been compared together in tables pretending to exhibit scientific conclusions !'
The half million sets of measurements, from which the conclusions to be summed up in this article were derived are open to none of these objections. They were actua with a ressonable exercise of care by surgeons sworn to d their duty, furnished with needful aids and appliances, and without object or interest in evading or slighting their off cial instructions. And the records include the measurement of rejected as well as of accepted men, so that they fairly $\mathbf{r}$ present, not a picked portion of the men of the country, bu he whole
It is proper to observe here that the measurements made use of in this report were chiefly those of men examined to wards the latter part of the war, after the finest fighting material of the country had been enlisted; consequently they under rather than overstate the average development of the American people. It was a time, too, when large bounties invited many of the better class of foreigners to enter our service: a partial explanation, perhaps, of the fact that in every instance the mean hight of our frreign-born soldier cumstances, it is gratifying to see that the first rank in stature is won by our native Americans, a somewhat discourag ing circumstance to those who assert that our country an climate are destructive to the white race. Curiously the list
is headed by a small number of aboriginal Indians. Dr. Baxter is of opinion that this is not due to their being picked men, but to the fact that the Indians are really a tall race. n Mr. Gould's tables of statistics, gathered by the Sanitary Commission, 517 Indians show a mean hight considerably bove that of the following table. If compared with the natives of the United States only, the Indians (enlisted Indins, that is) would rank as ninth in the list of States
Here follows the table showing the superiority in stature of $501,068 \mathrm{men}$, of different nativities :

| Nativity. | Number of Men Examined. | Mean High <br> in Inches. |
| :---: | :---: | :---: |
| United States, Indians, . | 121 | $67 \cdot 934$ |
| United States, whites, | . 315,620 | 67672 |
| Norway. | 2,290 | $67 \cdot 467$ |
| Scotland. | 3,476 | 67.066 |
| British America | 21,645 | 67.014 |
| Sweden. | 1,190 | $66 \cdot 896$ |
| Ireland | 50,537 | 66.741 |
| Denmark | 383 | $66 \cdot 648$ |
| Holland | 989 | $66 \cdot 637$ |
| Hungary. | 89 | $66 \cdot 584$ |
| England. | 16,196 | $66 \cdot 577$ |
| Germany-: | 54,944 | $66 \cdot 536$ |
| United States, colored, | 25,828 | $66 \cdot 531$ |
| Wales. | 1,104 | $66 \cdot 418$ |
| Russia | 122 | $66 \cdot 393$ |
| Switzerland | 1,802 | $66 \cdot 381$ |
| West Indies. | 580 | $66 \cdot 307$ |
| France | 3,243 | $66 \cdot 277$ |
| Poland | 171 | $66 \cdot 211$ |
| Mexico | 91 | $66 \cdot 110$ |
| Italy.. | 339 | $66 \cdot 000$ |
| South America. | 79 | $65 \cdot 899$ |
| Spain. | 148 | $65 \cdot 635$ |
| Portugal | . 81 | $65 \cdot 432$ |
| Total and mean of total | 501,068 | $67 \cdot 30$ |

Two thirds of the native-born white Americans were fair complexioned, but their mean stature was one tenth of an inch below the dark-complexioned. Among the natives of British America, England, Ireland, and Germany, the fai exceeded the dark in about the same proportion, while the dark show a slight superiority in stature, except in the case of Ireland, the light and dark complexioned natives of which had precisely the same hight.
Graded according to the mean stature of the inhabitants American born whites), the different Northern States stand as follows

| Order of Superiority Superiority | State. | Number of Men Examined | Mean Hight <br> in Inches. |
| :---: | :---: | :---: | :---: |
| 1 | Kentucky. | 4,252 | 68.677 |
| 2 | Kansas | 729 | 68.551 |
| 8 | Minnesota. | .. 3,682 | $68 \cdot 371$ |
| 4 | Missonri. | 6,031 | $68 \cdot 337$ |
| 5 | California | .. 1,308 | $68 \cdot 306$ |
| 6 | Nevada. | 21 | $68 \cdot 286$ |
| 7 | Indiana. | . 38,354 | 68.080 |
| 8 | West Virginia. | ... 5,187 | 68.005 |
| 9 | Wisconsin | . . 10,922 | $67 \cdot 911$ |
| 10 | Maine | .. 12,363 | 67.895 |
| 11 | Iowa | ... 7,823 | 67.895 |
| 12 | Illinois | .. 36,465 | 67.835 |
| 13 | Michigan | . . 12,583 | $67 \cdot 826$ |
| 14 | Maryland. | . 6,918 | $67 \cdot 814$ |
| 15 | Ohio. | .. 39,311 | 67.782 |
| 16 | Vermont. | .. 3,374 | $67 \cdot 583$ |
| 17 | Delaware . | ... 1,215 | $67 \cdot 490$ |
| 18 | Pennsylvania. | ... 47,124 | $67 \cdot 470$ |
| 19 | District of Columbia | .. 2,883 | $67 \cdot 353$ |
| 20 | Rhode Island. | . . 3,013 | $67 \cdot 290$ |
| 21 | New York. | . 43,798 | $67 \cdot 274$ |
| 22 | New Jersey..... | ... 17,084 | $67 \cdot 023$ |
| 23 | New Hampshire. | . 2,801 | 66.929 |
| 24 | Massachusetts | ... 6,280 | 66.891 |
| 15 | Connecticut. | . .. 2,099 | 66.587 |
|  | Total and mean of total | 315,620 | $67 \cdot 672$ |

According to Dr. Coolidge's examination of United States Army statistics, from 1839 to 1855, the mean stature of recruits from Georgia, Tennessee, North Carolina, South Carolina, Alabama, and Virginia ranged between $68 \cdot 272$ inches for the first and 67.488 for the last named. The average for the whole country, obtained from Dr. Coolidge's tables, was 67.357 inches, about one third of an inch below that derived from the records of the Provost Marshal General's Bureau ( 67.672 inches) for the Northern States; while that obtained by Mr. Gould, from the statistics of the United States Sanitary Commission-on the whole less accurately taken-was smaller yet, by about one hundredth of an inch. The close correspondence of the three sets of observations is an indication of the accuracy of the whole. Altogether they are the results of measurements of nearly a million and a half of
American born white men, and the resulting mean stature of the whole is 67.646 inches. Even the lowest mean obtained would entitle the American people to the first rank among the nations in point of stature.

Remarkable Artesian Well.-At Prairie du Chien, Wis., an artesian well daily discharges 869,016 gallons of water. The well is only 960 feet deep, but has nead enough to raise the water 900 feet above the ground.

Shocks of earthquake were felt, on July 5, at Corinth, Greece. The direction was east to west. On July 17 three violent shocks occurred in Vienna.

## IMPROVED DREDGING MACHINERY

The apparatus shown in our engraving is designed for cut ting canals, deepening lakes, etc., and can be largely used in the work of reclaiming land. The barge, which carries the machinery, and the frame for carrying the mast or jib are made of wood. A boiler, on deck or below, supplie steam to a small pair of engines on deck, which work two drums, two chains being necessary, which run over a double block or pulley, A. One shain, $P$, which may be a lighter one than the other, acts on the frame of the bucket, B B, and lowers it open. As soon as it is required to drag, the second or heavy chain, R, acts on the frames and side chains at D D. or heavy chain, R, acts on the frames and side chains at D D, and causes the shaft, E , to unwind, which causes the bucket
to close, as at C , and the sharp edges enter the ground. Though the edges jam, the chain goes on all the time, and the action becomes one of lifting, and the charge of earth or mud, of ten weighing two tuns, or measuring one cubic yard, is lifted through the water; and the man at the winch or or engine, knowing where he is going to dump it, puts in motion the wheels, $H$, acting on the chains, $G$, which guide the head of the crane, F, over the spot. As soon as the loaded bucket is over the barge, or the land where the charge is to be dropped, the man holds on to the first chain and lets the second chain slack, and the bucket opens, and so rapid is the motion that a single engine driver can excavate and dump four tuns per minute.
The barge is very often moored, says the Engineer, from which journal we select the engraving, by two poles or stilts at the sides, which are raised by a winch. This saves the time of pulling up an anchor, and keeps the barge steadier, and the advantage is that a mark can be tied on the chain; and whenever this comes to the same spot, the engine driver knows he is deep enough, and a level can be secured under water. When it is necessary to lift rock and stones, then the bucket is unhooked at 0 , and a pair of claws hooked on to the two chains, which claws act in a similar manner to the bucket. The tool is used for wrecking, and will work to the greatest nicety in a depth of water far below that at which any diver could descend. It has also the advantage that two men can work it with ease.

The Philadelphia Exhibition.
As time progresses, the Centennial Exhibition at Philadelphia arrives at a condition of more perfect completeness,
and with the bright summer weather the surrounding grounds attain even more beauty than they possessed upon the opening day. The crowds, which are almost lost within the great enclosure, save at the special points of popular attraction, increase in number every week; and though proba bly some slight falling off in the attendance is to be expected in the burning months of July and August, there is little reason to doubt that this decrease will be far more than made up by the mass of visitors during September and October always the two most crowded months at any exhibition.
The Exhibition is but, as it were, a handbook only to the great industrial developments of the United States, developments which to be believed must be seen, and which when seen, fill one with astonishment that so much could have been effected in so short a time. The admirable address of the Hon. Abram S. Hewitt, President of the Institute of Mining Engineers, gives the reader some idea of the magnitude of two of the most important branches of industry in the United States-its mining and metallurgy-from the time when, in 1622, one hundred and fifty workmen were sent to the American colonies to erect ironworks, until today, when 2,108,000 tuns of iron represent the production of last year. Of every different mineral, indeed, except tin, the United States possesses, practically, unbounded resour. ces; of coal the quantity is equally unlimited; of petroleum he alone possesses, as far is now known those strange she aled subterranean the discovery of which created, fot many years ago, so wild an excitement, and by which the whole world is supplied from some 3,600 wells in the State of Pennsylvania, and which furnish an average of about 24,000 barrels of oil daily. The Centennial Exhibition contains specimens of nearly all these sources of national wealth; and though they do not of themselves afford much information to the visitor, all information respecting them may be obtained, and the centers of the various industries visited; for though distances are great, the facilities for overcoming them are great also, and the inconveniences of travel in the United States are reduced to a mini mum.
But manufactures of all kinds may be studied fully within the limits of the Exhibition itself, and the position attained by the United States to-day, in the production of woolen, cotton, and silk goods, would astonish many European manu facturers who look to a freedom from transatlantic monopo
ly for all time, notwithstanding that to-day the export of cotton goods from New York to Liverpool is considerable, if not at present very lucrative.
We have already referred to the admirable arrangements made for the benefit of visitors who wish to go to different parts of the country and study different industries. There never was an exhibition held at which so many facilities were offered in every direction, so many kindnesses shown, so much trouble taken, and, let us add, so much that would be worth seeing and studying, if the distances were not so magnificent. But so many thousand miles have to be traversed, and time for most visitors in Philadelphia is limited, while their duties unfortunately are not, that only a very small proportion of what should be seen can be visited, despite the opportunities afforded, and the universal anxiety to aid the stranger in every possible way.-Engineering.

## Wool Greasing.

A Mr. Lebrun mentions, in a German paper, that a considerable quantity of oil may be saved by the following process of oiling wool, besides insuring a more uniform and regular web, on account of the woolen fibers loosening and separating themselves more easily from each other. Moreover, this plan, it is said, is not open to the objectionable features of some processes, which sometimes cause the total disap pearance of fine color dyes; and the cards wear longer and better, besides allowing the wool to be more easily and economically cleaned.
To obtain this preparative, pour into a wooden trough 20 parts oil, with 10 parts of liquid ammonia, adding 5 parts of water. Stir up this liquor with a wooden spoon, and, by inserting a steam pipe, allow the same to boil until the strong smell of ammonia has evaporated, after which the oiling or greasing may be proceeded with in the usual manner.

## New Size for Cottons.

Haitra is procured from China and Japan, and may be used for thickening colors and sizing all tissues. For use it is washed in water and is then boiled with sixty times its weight of water, in a closed vessel, at $65^{\circ} \mathrm{Fah}$. The paste thus obtained will keep, and adheres to the fiber so tena ciously that when once dry it cannot be removed with cold water.


IMPROVED WOODWORKING MACHINERY.
A growing demand is noticed among manufacturers in wood for machines combining the functions of several different tools in one, thereby economizing space in the factory and capital in investment. These machines are, from the great range of work for which they are adapted, known as universal woodworkers.
In the manufacture of builders' material, sashes, doors, etc., as well as in the production of furniture, agricultural
motion of which can be instantly started or stopped, or given a quick or slow motion, as may be required. The inside and outside cutterheads can be swung to an angle, and have a vertical adjustment with the table to which they are attached. The under cutterhead is adjustable for different thicknesses of cut, and can be used for forming moldings on the under side of the stuff. This molding side is provided with the same features and adjustments for making accurate
continuous table by fitting in slides of the proper form. The fence is attached to and moves with the forward table, can be adjusted to an angle of $45^{\circ}$, and is arranged to receive stud springs for holding down the lumber, and for bolting the panel-raising attachment.
The machine is very complete in all particulars, and the desirability of the combination can hardly be called in ques tion. This machine can be seen in daily operation at the space of J. A. Fay \& Co., Machinery Hall, Centennial Build-


## J. A. FAY'S UNIVERSAL WOOD WORKER

mplements, railroad cars, patterns, etc., such machines are almost invaluable. Their true value, however, is based upon the ease with which they can be adjusted, and the facility with which the changes can be made for the different kinds of work.
The apparatus illustrated herewith combines all the features of the variety woodworkers and hand planers of the same manufacturers, with a complete molding and flooring machine. The essential features of the original Climer \& Riley patent on woodworkers are all included, together with many novel and important improvements and labor-saving devices, originated by the makers.
The two sides of the machine are driven from one countershaft, which is so arranged as to convey the power to both sides simultaneously or separately, as the operator may desire. The double friction pulley on the countershaft is caused to come in contact with the driving pulleys for the utterheads by means of two levers, one for each operator, by which he sets in motion or stops his side of the machine as he may desire. This method of obtaining independence of the combination is new and effective, as two operators can perform their work, one on each side, without either interfering with the duties of the other.

Upon the molding side, the moldings can be worked to eight inches in width, also narrow surfacing and flooring to eight inches in width. This side is furnished with a pair of | eight inches in width. This side is furnished with a pair of |  |
| :--- | :--- |
| powerfully geared and | $\begin{array}{c}\text { The tables are furnished with grooves for receiving the }\end{array}$ |
| gaining frame slide and other attachments, and for making a |  |

ings, section B 8 , columns $61,62,63$. Any desired infor mation will be furnished on application to the manufactur ers, Cincinnati, Ohio.
[This description was published in our issue of August 19, the other engraving being, by an inadvertence, published therewith.-EDs.]

IMPROVED SIX-ROLL PLANER, MATCHER, AND BENDER. Changes in machinery for working wood are so numerous and important in their effect on the trade that we feel justified in giving those who are interested in this class of tools the fullest opportunities of information in regard to any new machines of value which may be produced.
The machine herewith illustrated is manufactured by the well known wood tool builders, J. A. Fay \& Co., of Cincinnati, Ohio. There are two cylinders, one for planing the upper surface of the board, and one for the under surface each having two driving belts and three knives twenty-six inches in length, and being fitted with steel journals, and steel lips for chip breakers.
The two vertical sideheads are of gun metal, each having three cutters, and are adjustable for different widths of lumber to be jointed or tongued and grooved. They are also arranged to drop vertically below the bed to admit of surfacing the full width of the knives without removing the surfacing the full width of
heads from their spindles.
The feeding mechani sm consists of six rollers, six inches

in diameter, in three pairs, connected by heavy expansion gearing at each end of the rolls. The rolls and upper cyl inder can be elevated to take in lumber five inches in thickness. The upper rolls of the contiguous pairs are adjusted simultane
The under cylinder is adjustable vertically for graduating the thickness of the cut, and is placed so that the discharg. ing rollers carry the lumber from it. This is a novel and dis tinguishing feature of this planer, the rolls through which the lumber last passes being placed outside of the under cylinder and bending pressure bar, which is placed and adjusted over the under cylinder.
These rolls are usually placed in the machine so that the under cylinder does not commence cutting until the board has passed some distance through, and consequently a portion of the board must depend upon being driven over the under cylinder by the board following. This defect is obviated by the new position of the cylinder and the discharging rolls.
Accessibility to the under cylinder is facilitated by the method adopted of moving the discharging rolls by revolv ing the end of the machine supporting them upon a hinge in one side of the frame; and the pressure bar over the under cylinder, being revolved upon one of its supports,leaves the under cylinder entirely open for any purpose of adjust ment the operator may desire. The side cutterheads, being adjacent to the under cylinder, can also be more readily adjusted by virtue of the position thus attained.
This arrangement is a very desirable one, and the end of the machine is claimed to lose none of its stability, as the supports are of the most permanent character, easy of access and attached or detached very quickly.
The lower roller on the movable end of the machine has a vertical movement to compensate for any changes in elevation of the under cylinder, and in order that a constant pressure may be retáined upon the lumber by keeping the peripheries of the cylinder and roller in the same relative position.
One of the machines may be seen on exhibition in daily operation in Machinery Hall, section B8, columns 61, 62, 63, Centennial Exhibition, Philadelphia, or further particulars can be obtained by addressing the manufacturers at Cincinnati, Ohio.

## [For the Scientific American.] THE EXHIBIT OF CORNELL UNIVERSITY AT THE CORNELL UNA. CENTENNIAL.

In the account of technical schools recently published in the Scientific American, the exhibit of the mechanical the Scientific american, the exhibit of the mechanical engineering department of Cornell University was omitted,
as the articles shown by this school are of such an interestas the articles shown by this school are of such an
ing character as to warrant a separate description.
Cornell University, as most of your readers doubtless know, furnishes courses in almost every branch of learning but the present notice must be confined to the practical part of the course in mechanical engineering. This course covers a period of 4 years, during which each student is required to work for 10 hours a week in the shop. Some of the results of this work are shown at the Centennial, and the visitor is not deterred from making a critical examination by notices that handling is forbidden, but, on the contrary, is invited
to subject the articles to any test that he may desire. Some surface plates, placed upon a low table, are particularly insurface plates, placed upon a low table, are particularly in-
viting to the passing visitor, who can make one plate float viting to the passing visitor, who can make one plate float
upon the other, and, after working out the air between, can upon the other, and, after working out the air between, can
lift the pair by grasping the upper one. These surface lift the pair by grasping the upper one. These surface
plates are a regular article of manufacture at Cornell University, and are sold at such a reasonable price ( 10 cents a square inch) that it is a matter of surprise to find that they are not in great demand. The scholars also make steel triangles for the use of draftsmen, and these will be found very serviceable for nice work. Professor Sweet, who is in charge of the practical course at Cornell University, proposes to add, to the articles manufactured for sale, solid calipers, accurately ground to standard sizes, which will be as useful as the well known Whitworth gages, and much ufacture is an instrument for accurate measurement ; and a ufacture is an instrument for accurate measurement; and a
measuring machine reaching to ten-thousandths of an inch measuring machine reaching to ten-thousandths of an inch
has been made at the school. This is constructed on the general principle of Whitworth's measuring machine, but has some important improvements. The principle of the machine is the same as that of the sheet metal gage made by Brown \& Sharp, in which the measuring points are brought together by a screw, and the fractions of the revolution are measured on a wheel attached to the screw. In
the machine under consideration, the screw has a pitch of $\frac{1}{16}$ of an inch, and the wheel is divided into 625 equal parts, each of which measures a movement of $\frac{1}{1000}$ of an inch. In the use of a machine of this kind, it is found that, if several operators each measure the same arts by their judgment, their results will vary sensibly points by their judgment, their results will vary sensibly;
and one of the improvements of the present machine consists and one of the improvements of the present machine consists
in having the handle which moves the screw independent of it, being kept in contact by friction until the measuring point bears against the article to be measured, when it slips. Another importantimprovement over the Whitworth machine is the use of a short screw, and a nut of the same
length. By this arrangement, the motion of the measuring length. By this arrangement, the motion of the measuring point attached to the screw is only about an inch, but the other point is adjustable on a slide to any desired distance
up to one foot, so that the range of the machine is for articles from $\frac{1}{10000}$ to 12 inches, varying by ten-thousandths. A steam engine, built by the students, from Professor Sweet's design, has several novel features. The frame has three
supports, the cylinder resting in a socket upon one, and be
ing free to move under changes of temperature. The pisto is made very long, and has a number of grooves, no packin being used. The piston rod passes through a grooved tube without any packing, and the valve stem, also without packing, works through a plain brass tube of considerabl length. The valve consists of two flat plates, accurately fit ted to the valve seat and an upper plate, thus being per fectly balanced, and being made very thin, to obviate as fa fectly balanced, and being made very thin, to obviate as fa
as possible the difficulties caused by unequal expansion The possible the difficulties caused by unequal expansion
is attached to the fly wheel, and is connected with the eccentric, which swings round a point near on edge, under the action of the governor. The effect of mov ing the eccentric is to change the amount and period o opening of port, while the lead remains practically constant The eccentric acts on the valve stem through the medium of a bell crank lever, so as to equalize the cut-off at each end of the cylinder. The valve motion of this engine, it will be seen, is quite novel, and it may be illustrated and mor fully explained on some future occasion. A model of the valve is shown, with a neat arrangement for tracing a dia gram of its action. The crosshead of the engine is unusu ally long, and the connecting rod, instead of vibrating on he pin, is rigidly attached to it, and the pin moves in bear ings on the crosshead. This arrangement greatly facilitate accurate adjustment. The crank pin works in cast iron boxes. The main bearings have considerable side play. It
would be impossible, without illustration, to give a thor would be impossible, without illustration, to give a thor
ough explanation of the features which have been briefly enumerated. The design in building the engine was to giv the students some idea of the requirements of a good en gine. The result is a substantial machine, and one which will probably be serviceable as constructed at present though it will be noticed that some of the details are expe rimental. It will be easy, however, to use packing, if it should be found necessary. The engine has a diameter of 6 inches and a stroke of 12 , can be run at a speed of 300 revo lutions a minute, and will be sold for $\$ 750$.

If any of your readers is looking for a complete foot lathe he will do well to visit this exhibit. The amateur foot lathe made by the students, is the second that has been con structed at their shop, and seems to be as nearly perfect a machine of the kind as is usually met with. It has a 4 foot bed and 10 inch swing. There are three speed wheels fo the driving belt, an internal back gear on the head stock, three friction feeds, and change wheels forcutting screws of 26 different pitches. The machine is adapted to all kinds of work that can be done on a lathe, straight and taper work, turning spheres, etc. The slide rest moves on one flat and one $V$ way. There is an adjustment for a slight movement of the tool, such as may be required in screw cutting. One wrench fits all the nuts which must be loosened to make adjustments. Handles are fitted to all parts in which frequent changes are required. The rock shaft of the treadle motion works on knife edges, and requires no lubrication. On removing the foot from the
treadle, it becomes detached from the pin of the connecting rod, and is caught and held up by a spring. There are drawers at the back of the machine for the extra wheels and tools. This machine is offered for sale at the very moderate price of $\$ 400$. It is probable that it will be bought by some amateur who knows how to appreciate work of thi some
kind.
The engine in this exhibit drives a Gramme machine which has the power of a Grove battery of 100 cells. This machine was built by the students, from designs furnished by the Professor of Physics, and is, so far as the write knows, the only machine of the kind built in the United States. It furnishes power for several electric engines used by another exhibitor for driving a lathe, a sewing machine, and a mill, also for an electric light, and for burn
ing wire. The machine has sever ing wire. The machine has several ingenious adjustments or switches by which the direction and quality of the cur rent can be changed, and it can also be used as an electric Phin, driven by a battery.
Philadelphia, Pa .
R. H. B.

\section*{For the Scientific American.]

## For the Scientific American.] <br> THE FACTS OF THE LAWS OF GRAVITATION.

The crucial test for the correctness of a scientific theory is he inquiry whether it will enable us to predict phenomena and whether experiment or observation will verify ever prediction. Recently a member of the French Academy
stated that he had conceived a new theory of electricity, stated that he had conceived a new theory of electricity
and was at once asked if it had enabled him to foresee phe and was at once asked if it had enabled him to foresee phe-
nomena, and if he had found practically the verification of his prediction. His answer was affirmative, but not as posi tively so as strict science requires, and his theory is there fore still an hypothesis.
Among all the scientific theories, there is none more firm y established than that which maintains the universality of gravitation, and establishes the laws governing it. W avoid speaking of a theory of gravitation, because we cannot help considering gravitation as a stubborn fact, and not s a mere speculation. That bodies fall to the ground, and after having falling exert an amount of pressure on their support in proportion to their mass, is a simple, universally ecognized fact, without any theory about it; and this is what we call gravitation, which means simply that matter is heavy, and that twice or thrice the mass is twice or thrice as heavy. But the laws which govern gravitation, the uni versality of its action, and its presence throughout the whole Universe : these form a theory, which is susceptible to proof.
redictions of phentific theory was thoroughly tested,
tances, it is this; and if ever any theory was fortified by the subsequent observation and verification of the predicted phenomena, it is this. It has been attacked in some quarters, even by persons of education, and doubts have been thrown upon its teachings. This was done by the great German poet and philosopher Goethe, among others; buthe was simply ignorant of the facts. Every man judges about things according to the amount of information in his pos session; and if Goethe had been informed of the manifold facts verifying this theory, he would surely never have atacked it. Unfortunately he did not know anything about mathematics, which is the science of the laws governing space and time, and therefore the key to all natural philoso phy ; neither had he ever received any training in practical bservation and experiment, his large treatise on optics be ing a gigantic confession of ignorance of the subject, and also of his inability to draw correct conclusions from phe nomena observed. He erred equally when treating of gravitation; he showed that he had not the least comprehension of the established theory, forgetting, as he did, that, in order to criticize anything thoroughly and successfully, we must first understand it well. Hence his strictures upon he Newtonian theory go for nothing, and have weight only mong those who know as little about it as Goethe did ; and mong those who know as little about it as Goethe
Newton tested his theory by the motion of the moon, and found that, if terrestrial gravitation (which is no theory, but a fact) extended to the moon, and diminished inversely as the square of the distance from the earth's center, it would, as the moon is at a mean distance of 60 terrestria radii, be $60 \times 60$ or 3,600 times less in power on the moon As a body on our earth falls nearly 16 feet in the first second, it would, at the distance of the moon, fall 3,600 times as slowly; and as an hour is 3,600 seconds, it would there fall in an hour no further than near the earth's surface in second, so that the moon falls every hour 16 feet towards the earth. Comparing with this figure the tendency of the moon to move in a straight line, as is the natural property f all moving bodies, and the moon's consequent tendenc o fly off in a straight tangent from its curved orbit,he found hat, if terrestrial gravitation or a.ttraction were withdrawn, she would in an hour be 16 feet further from the earth, thi entrifugal force appearing exactly to counterbalance the errestrial attraction at that distance, and proving that it really was 16 feet for the first hour: verifying thus the law that the attraction is inversely proportional to the square of he distance.
That this terrestrial attraction or gravitation was partially counteracted, even on the earth's surface, by the earth's ro ation around its axis was proved by the fact that this at raction was stronger near the poles, where the circle of ro ation is smaller and the velocity less, and weaker unde he equator, where the circle is larger and the velocity reater; while in the latter case the centrifugal tendency is in a direction exactly opposite to that of gravitation, so hat bodies weigh more at the poles than near the equator That the terrestrial attraction is not a property of the arth, but is diffused throughout all matter, so that all bodes attract all other bodies, was proved by the torsion balance of Coulomb, by which he proved that a heavy mass, sud enly brought before a small ball delicately suspended in a glass case, will attract the latter from its position ; he even measured the amount of this attraction for masses of a given weight, and in this way came, by comparison, to the knowledge of the mass of our whole earth.
That the terrestrial gravitation is not concentrated in the arth's center, but a resultant of the sum total of all the ndividual attractions of every particle contained in it, is proved by the diminished gravitation when descending in a mine. If indeed the attraction solely resided in the cen er, it should increase when going down; but being a resul of the attraction of the whole mass, the central attraction is counteracted by the attraction of all masses above the ob erver; and hence gravitation decreases with the depth and if it were possible to reach the earth's center it would be found there to be zero, the attraction being balanced all round.
In Herschel's "Astronomy," published many years ago, n arrangement is suggested for observing the difference in ravitation on the earth's surface, by counteracting it by a force'not dependent on gravitation, namely, a spiral steel pring. It is evident that, if we wish to ascertain whether a mass of say 1 lb . in weight, weighs less under the equator han near the poles, we must not use a 1 lb . weight as counerpoise, as this would be equally affected by the terrestria attraction; but if we use a spring to suspend it from, we shall observe less tension in the spring on which the mass of 1 lb . is suspended when brought to a locality where the gravitation is less, as is the case under the equator, than it is at the poles.
The apparatus suggested by Herschel is but a rough contrivance, and only fit to show that there is a difference, and it is not adapted to measure the amount of this difference. It consists of a stand from which a spiral spring is suspended, to the lower end of which a weight is attached. The weight and spring are so arranged that, when the whole machine is laced perpendicularly, the weight will just touch a piece f glass plate, inserted in the base under it. If now this pparatus is carefully packed up so as not to disturb anything, and transported to a locality where gravitation is
less, it will, when set up again, show that the gravitation is less, it will, when set up again, show that the gravitation is
not sufficient to draw the weight down until it touches the glass plate.
Siemens has succeeded in constructing an apparatus, founded on this principle, so perfect that he can measure
the diminished gravitation with sufficient accuracy to calcu-
late the distance from the earth when in a balloon; and not only this, but, as water is of less density than the earth, he can also calculate from its indications the depth of the ocean Evidently the gravitation at the ocean's surface must de crease in proportion as the depth increases; because, when there is more water under the ship's bottom (water having less weight than earth) its attraction will be, proportionally to its mass, less. This instrument, which has been de scribed in the Scientific American Supplement (page 368, volume I), is thus constructed in entire accordance with the theory of the law of gravitation ; and having been fully verified by experiment, it is an additional confirmation of this theory, of which the ultimate triumph is as complete as that of any theory in the whole field of Science.
New York city.
P. H. Vander Weyde

## [For the Scientifc American.]

## nickel and its preparation.

Nickel is not an abundant metal; and although it occurs in a dozen different ores, the number of localities where it it is found in paying quantities is very few. It is never found in a metallic state, except in meteorites. In ores, it is generally associated with iron and cobalt, both of which it resembles. The principal source of nickel is the native arsenide, a copper-colored mineral, called by the Germans kupfer-nickel, or false copper, because it contains no copper. This ore contains from 33 to 55 per cent of arsenic, 33 to 45 per cent of nickel, and small quantities of sulphur, iron, and other substances. Another compound of nickel and arsenic has received the name of cloanthite or white nickel. Annabergite, or nickel bloom, is a compound of arsenic acid with oxide of nickel, quite soft and of an apple green color. The most beautiful nickel mineral is the sulphide, or mil. lerite. It has a brass yellow color and metallic luster, and usually occurs in capillary crystals, in the cavities and among the cristals of other minerals, hence called capillary pyrites In this country it is found chiefly in Lancaster county, Pa. The other nickel minerals are breithauptite, nickel glance, ullmanite, emerald nickel, pyromelin, grunanite, pimelite, garnierite, and nqumeite. Speiss is a deposit formed in the pots in which roasted arsenide of cobalt, mixed with copper nickel, is fused with carbonate of potassium and quartz, for the preparation of smalt, in the blue color works; it collects below the blue glass, in the form of a metallic alloy, the nickel not oxidizing so easily in roasting as the cobalt. It is an important source of nickel
Of the metallurgy of nickel little is known outside of the works, which are carefully guarded, although it is difficult works, which are carefully yuarded, although it is dificult
to see of what use a knowledge of a process could be to those to see of what use a knowledge of a process could be to those
who have no source of material at hand, or why those who who have no source of material at hand, or why those who
have a monopoly of the ore need fear competition. Professor C. Küntzel has, however, published some interesting facts in regard to the method used in the metallurgy of nickel, from which we glean the following:
The preparation of metallic nickel and cobalt is sometimes conducted in the dry way, by collecting and concentrating the nickel, cobalt, and copper, in an arsenical or sulphur compound (speise or stone), while, at the same time, the iron wards fluxed with pure quartz sand, and the protoxide of ward flused with pure quartz sand, and the protoxide of
cobalt precipitated, from the silicate of cobalt thus formed. by fusion with excess of carbonate of soda; the sulphur or by fusion with excess of carbonate of soda; the sulphur or
arsenic is expelled from the speise, which has had the cobalt arsenic is expelled from the speise, which has had the cobalt
removed by roasting and heating with soda and saltpeter, and finally reduced with carbon. It is more frequently obtained in the wet way, by dissolving the nickel and cobalt ores in acids and separating the dissolved metals; but the greater part of the iron should first be removed and the nickel and cobalt concentrated before dissolving. In the dry method the first step is also to get rid of the iron in the ore or speise. The complete separation of iron from arsenical compounds of nickel and cobalt is not very difficult, for iron has much less affinity for arsenic than cobalt or nickel; but to separate it from the sulphides was, until recently, very
difficult, if not impossible. The reason of this is that nickel and cobalt have nearly the same affinity for sulphur that iron and cobalt have nearly the same affinity for sulphur that iron
has. This operation is now accomplished by smelting the has. This operation is now accomplished by smelthg tix
rawferruginous ore in a reverberatory furnace, with a mixture of two parts of fine barytes and one part quartz sand for 1 per cent of iron, 18 to 19 per cent of this flux is required. A fusible ferro-silicate of barium is formed and sulphurous acid driven out. In 1870, Dr. R. Wagner proposed to make use of the oxidizing action of Chili saltpeter for removing the iron, sulphur, and arsenic. For arsenical
products, this method is inferior to the one generally emproducts, this method is inferior to the one generally employed, namely, roasting the metallic arsenides after the iron has been removed, then heating with saltpeter and so-
da. Wagner's method may be employed with advantage when it is desired to smelt a nickel ore, which has been freed from iron, with a metal free from sulphur, provided it contains enough copper to prevent the resulting metal from betains enough copp.
ing too infusible.
The manufacture of nickel in the wet way varies with the material or source. The principal steps are the following 1. Dissolving the roasted products in hydrochloric or sul phuric acids. 2. Precipitation of the iron by means of lime or carbonate of lime, or soda, after oxidizing, if necessary, with chlorine or chloride of lime. 3. Precipitation of the copper with sulphuretted hydrogen, or alkaline sulphides.
4. Precipitation of the cobalt as sesquioxide by means of 4. Precipitation of the cobalt as sesquioxide by means of
chloride of lime. 5. Precipitation of the nickel as hydrated oxide or carbonate with milk of lime or carbonate of soda. 6. Igniting this precipitate so as to obtain anhydrous oxide of nickel, insoluble in dilute acids. 7. Leaching out the ex cess of lime and gypsum from the ignited oxide of nickel.
8. Reduction of the pure oxide of nickel by ignition with charcoal.
In dissolving nickel ore, care should be taken to prevent silica going into the nickel solution, for, on neutralizing the previously acid solution, all the silica is precipitated in the form of silicate of nickel. Sometimes in analyses a small quantity of silicic acid runs through all the operations, and there is no simpler method of removing it entirely at the
start than by adding to the neutral solution some neutral start than by
nickel salt.
For precipitating the copper with sulphuretted hy drogen, Gerstenhoefer's precipitating tower, which was first employed at Freiburg to precipitate arsenic from sulphuric acid, may be employed. Such an apparatas avoids any escape of the gas, and precipitates the metals in the shortest possible time. The solution enters automatically at the top of the tower, which has an hydraulic seal. It falls, drop by drop, down into an atmosphere of sulphuretted hydrogen, passing from one platform to another: and if it does not contain too much copper, it passes out at the bottom free from copper. The gas, which
is absorbed by the nickel solution, is expelled by heating it is absorbed by the nickel solution, is expelled by heating it
with steam. If a soda ash works is near, the waste sulphide of calcium may be employed with profit for precipitating the copper. Injury to the workmen from inhaling sulphuretted hydrogen can be prevented by the, ase of wine or spirits sulphuretted hydrogen retards the circulation of the blood, which is neutralized by the property that alcohol has of accelerating the circulation.
Nitrite of potash cannot be employed to separate nickel and cobalt when there is lime in the solution. In this case it cannot even be used as a test ; for in the presence of lime or other alkaline earth, a yellow precipitate is formed,similar to the nitrite of cobalt and potash, and said to have the to the nitrite of cobalt and potash, and said to have the
composition $\mathrm{K}_{2} \mathrm{CaNi}\left(\mathrm{NO}_{2}\right)_{\text {e. }}$. If there is enough lime precomposition $\mathrm{K}_{2} \mathrm{Ca} \mathrm{Ni}\left(\mathrm{NO}_{2}\right)_{\text {e. . If }}$ If there is enough lime pren
sent, all the nickel is thrown down as a double nitrite.
sent, all the nickel is thrown down as a double nitrite.
Cobalt and nickel may be separated by means of sulphat of ammonia and sulphuric acid, if the quantity of cobalt is not too small relatively. The separation is quite exact if the solution is sufficiently concentrated. The nickel separates as a difficultly soluble double sulphate of nickel and ammonia, while the double salt of cobalt remains in soluby heating in clay pipes. The sulphate of nickel is almost entirely converted into oxide by roasting with charcoal ; the last trace of sulphur is removed by igniting with soda and saltpeter.
The best method of removing the sulphate of lime is to extract the excess of lime added with hydrochloric acid wa ter, then to boil the oxide with steam, and add slowly such a quantity of carbonate of soda that, after boiling a quarter of an hour, there is still an excess of the carbonate in the solution. Sulphate of soda and carbonate of lime are formed; the first is washed out with water, and the latter with water acidified with hydrochloric acid.
Oxide of nickel can be reduced at a bright red heat by simple contact with coarse broken charcoal. The reduction extenas inwardly from the surface of the cubes. If left in contact with the carbon after it is entirely reduced, it absorbs more and more carbon. The reduction usually take place on the clay crucibles on the hearth of a flame furnace At Val Benoit, near Lattich, a continuously working fur tubes. used, the reduction being accomplish in uprigh tubes.
E. J. H.

## [For the Sclentifc American.] <br> scientific apparatus.

At the loan exhibition of scientific apparatus, now open at the South Kensington Museum, London, free evening lectures are delivered on scientific subjects. The collection includes apparatus of the most primitive and ancient forms, the specimens of the successive improvements down to sonal interest, as associated with the names, labors, and discoveries of eminent scientific men, mechanicians, discoverers, and inventors. On a recent occasion, the lecturer, Mr. Chandler Roberts, F.R.S., chemist of the mint, took for his theme: " The Apparatus Employed in the Researches of the late Master of the Mint, Mr. Graham." The name of Thomas Graham is well known as the author of "Elements of Chemistry." His scientific papers, published in the
transaction of societies, range in date from 1834 down to transaction of societies, range in date from 1834 down to
1869, the year of his death
The lecturer, with specimens of apparatus before him, both that of Mr. Graham and of others, gave a very interesting discourse. In its scientific aspects, and in its comparison of the processes followed, the reasoning employed, and the there is obtained, the lecture was very interesting. Bu interest, as demonstrating that the essential apparatus for scientific researches is found in the mind, the memory, the power of analysis and comparison, in the ingenious adaptation of means and implements : in a word, in the genius of he discoverer.
Mr. Roberts concluded his lecture by saying that, although for delicate researches or measurements complicated instru-
ments are necessary, still the most ordinary appliances, in the hands of a man of genius, are capable of fielding very im portant results. With a glass tube and a plug of plaster of Paris, Mr. Graham discovered and verified the law of the diffusion of gases. With a tobacco pipe, he gave additional evidence that atmospheric air is a mechanical mixture of its constituent gases. By the aid of a tambourine and a basin of water, he divided bodies into crystalloids and colloids, and obtained silicic acid, and oxide of iron soluble in water With a toy balloon of india rubber, filled with carbonic
acid gas, he separated oxygen from atmospheric air, and developed points, the importance of which it is impossible to verrate from a physiological point of view. By the expan sion of a wire which attended its absorption of a gas, he did auch to prove that hydrogen is the gas of a white metal. Such facts as these are of great interest to mechanics and operative chemists, whose daily occupation is the proof of mechanical and scientific discoveries, the application of laws and facts already discovered. Their daily employment is suggestive ; and if they have active minds and patient habits of observation, there are frequent chances for testing the value of their thoughts and the possibilities of improvements in machinery and processes. "If" they had only such and such tools, or apparatus ! The "if" must be met as Thomas Graham met it.

## Liquid Indicator.

Dr. Ciemens has designed an instrument by whicha stream of alcohol and water mixed in any proportion is measured in such a manner that one train of counter wheels records the volume of the mixed liquor, while a second counter gives a true record of the amount of alcohol contained in it. The principle on which this measuring apparatus acts may be shortly described thus: The volume of liquid is passed through a revolving drum, divided into three compartments by radial divisions, and not dissimilar in appearance to an ordinary wet gas meter ; the revolutions of this drum pro duce a record of the total volume of passing liquid. The liquid, on its way to the measuring drum, passes through a receiver containing a float of thin metal filled with proof spirit, which float is partially supported by means of a care fully adjusted spring, and its position determines that of a lever, the angular position of which causes the alcohol counter to rotate more or less for every revolution of the measuring drum. Thus, if water only passes through the apparatus, the lever in question stands at its lowest position, when the rotation motion of the drum will not be communi. cated to the alcohol counter ; but in proportion as the lever ascends, a greater proportion of the motion of the drum will be communicated to the alcohol counter, and this motion is rendered strictly proportionate to the alcohol contained in the liquid, allowance being made in the instrument for the change of volume due to chemical affinity between the two liquids. Several thousand instruments of this description are employed by the Russian government in controlling the production of spirits in that empire, whereby a large staff of officials is saved, and a perfectly just and technically un objectionable method is established for levying the excise dues.-Nature.

## Naval Items.

## redtction of pay and men.

"Abstract of general order No. 216,dated August 12,1876 The estimates made for pay of the navy for the current year were $\$ 7,600,000$. Congress, however, determined that by a very rigid enforcement of a somewhat disused powe on the part of the secretary of the navy to furlough officers, instead of having them under the heads of "other duty" or "waiting orders," a very considerable reduction could be made; and appropriated for the current year, for the pay of the navy to be administered upon this plan, and also reduced by cutting off 1,000 from its former complement of 8,50 men, the sum of $\$ 5,750,000$, or nearly $\$ 2,000,000$ less than the amount of the estimates. Under these circumstances, the department, although entertaining different views, feels bound to make, in good faith, the effort to bring the actual expenses of this branch of the service as near as possible to the amount appropriated by Congress. This can only be done by reducing the number of officers employed, to those absolutely needed to meet the daily pressing requirements of he service, and by putting those unemployed upon the low est pay recognized by the provisions of existing laws.
'It is therefore ordered that: Until further orders, all officers not on duty on September 1 next, and all on leave will, at the expiration of leave or waiting orders, be re garded as on furlough, and will be so paid.
"The foregoing applies only to the active list of the navy, the pay of retired officers being fixed by special provision of aw."

## naval engineer corps gazette.

Chief Engineer James B. Kimball, detached from the U. S. steamer Hartford, and as Fleet Engineer of the North Atlantic Station, and placed on waiting orders.
Chief Engineer A. J. Kiersted, detached from the U. S. steamer Vandalia, and ordered to the Hartford, and also to discharge the duties of Fleet Engineer of the North Atlantic Station.
Chief Engineer Joseph Trilley to the Vandalia
Cadet Engineer George S. Willits, detached from the Vandalia and placed on waiting orders.

A Panic among Sponge Divers.
Mr. Vice-Consul Jago, writing from Beyrout, says that the last crop of Turkey sponge was very deficient, and prices of ordinary and common sponges have greatly risen in con-
sequence. The def ciency is attributed to a panic among sequence. The deficiency is attributed to a panic among the divers, caused by the appearance in the neighborhood of Batroun, Mount Lebanon, the chief sponge fishing locality, of a sea monster, alleged to have been equal in size to a small boat. Its actual depredations among the divers ppear at the present time to have been limited to one man, whom he is said to have swallowed whole.

A square of 208.72 feet each way covers one acre, so alse A square of 235.5 feet in diameter

## IMPROVED BOAT-LOWERING APPARATUS

 We illustrate herewith a new boat-lowering apparatus, in which the inventor seeks to use the buoyancy of the boatas a means of detaching it from the falls. He has contrived the hooks, whereby the latter is fastened, so that they will open when the weight of the boat is taken by the water. The release is thus automatically effected. In order to secure the even lowering of the boat, the inboard ends of the falls are wound about a drum bolted alongside the bulwarks, and the rotation of the drum is governed by a pawl and ratchet or other simple mechanism. The hook which forms the essential feature of the invention is illustrated in Fig 2. It consists of three parts 2. It consists of three parts two of which, A and B, are pivoted in lugs attached to the boat, and a third, C, is pivoted to one of the aforesaid parts, and enters a slot in the other. Over the part, C, the ring at the end of the fall passes; and so long as there is any weight suspended by the hook, its parts will maintain their relative position as shown in Fig. 2. When, however, the stress of the weight is removed, the part, falls from the upper part, C, falls from the upper portion of the slot whereit engages by the shoulder formedupon it, and is drawn out by upon it, and is drawn out by
the part, B, which falls flat, the part, B, which falls flat,
the part, A, doing likewise. The falls are thus instantly released, leaving the boat free. To hook the boat on for hoisting, it is simply necessary to insert the part, $=\mathbf{C}$, through the ring, and catch it in the s'ot. The parts are then held together until the weight of the boat rests on the hook the whequired The inventor required. The inventor provides a safety cord, which, as the boat descends, comes out of the hole at the end of the
small hook. This is intended small hook. This is intended to prevent all danger of the boat being lifted accidentally, and so released before the proper time. Fig. 1 shows the invention complete, as attached to a boat.
Patents pending through the Scientific American Patent Agency in this country, Great Britain, and France.
Mr. W. C. Brice has also invented an actinometer, or photographic testing plate, to be applied to a camera, for the purpose of determining the quality of the chemicals employed, and for discovering where the trouble lies in foggy and undefined pictures. It consists of a frame with a sliding glass, to which are applied fixed pieces of transparent material, superposed in layers in regular succession, to produce a graduated obstacle to the passage of light. Patents have been applied for on this improvement in the United States and several countries of Europe.
For further particulars address the inventor, W. Alexander Brice, care R. C. Poulter, 4a Middle Temple Lane, London, England.

DUEBER'S IMPROVED WATCH CASE
The obvious advantage of the stem-winder watch is that, as its winding apparatus is contained in the case, there is

no necessity for carrying a separate key. But many consider that the annoyance of lost or mislaid keys is of less importance than the liability of stem winders to get out of repair and their higher first cost, so that probably the majority of people prefer the older-fashioned system.
In the invention herewith illustrated, the object sought has been to combine a key with the case, making it form a part thereof in the place where the stem-winding apparatus
is usually located. The key, however, is detachable, and is sed to wind the watch in the ordinary way
In the engraving the key, Fig. 2, is shown inserted in Fig. A small projection inside the pendant enters slots cut in the side of the key, as represented in Fig. 3, and hold it in place. It suffices, in order to remove the key, to push it in and turn to the left; the reverse operation re-fastens it in place.
It is claimed that this arrangement involves but very lit extra cost, and that the key cannot get lost misplaced, r filled with dirt
For further information address the Dueber Watch Case
f water are liable to much fluctuation at different season of the year. More especially is it designed for use in pro pelling light machinery, such as printing presses, sewing machines, lathes, etc., wherever water can be taken from ydrant. It is also claimed to be well adapted for heavy work The disk of the wheel, A, Fig. 1, is made of brass of va ious sizes, and, together with the buckets, $B$ B, is of a pecu liar construction and of a capacity to correspond with the size of the stream and the power required. C C are the bel pulleys; $D$ the supply pipe; E a self-packing faucet or stop cock, which is the subject of another patent obtained by the same inventor. This faucet is capable of supplying one, two, three, or more stream of water of different dimen sions through the pipes, $F$, which are firmly held in po sition at the point of delivery of the water on the buckets by a shoe, G. The pipes are pro vided with bushings at thei extremity, which can be re moved at pleasure, and other of a different capacity inserted. The waste pipe, of course, can be arranged as required, eithe from the sides or bottom of th casing. The communication between supply pipe and buck ets is shown is buck ets is shown in section in Fig . Patented June 13, 1876 For further particulars addres the Little Giant Water Moto and Self-Packing Faucet Com pany, Glen's Falls, Warren county, N. Y., Frederick J. P Chitty, manager.

## THE WESTON DYNAMO-ELEC

 TRIC MACHINE.Our engraving represents a new electric machine, adapted more especially for electro plating. It is of simple plating. It is of simple con struction and, we are informed requires very little power The illustration gives an exte ti, Ohio.

IMPROVED WATER MOTOR.
The invention herewith illustrated applies water to a wheel of a novel construction, whereby the whole centrifugal force of a jet of water is concentrated on the center of the buck ets From these it is immediately discharged, thus avoiding any friction or dead lift, and imparting to the wheel not

ouly a greater impetus but, it is claimed, a very high degree of power, considering the pressure and the size of the stream used. Although adapted to all purposes where water is used as a motive power, this invention is more particularly designed for use where the supply of water is limited or variable; and this is believed to be a desideratum, as streams
rior view; the mechanism is as follows: From the interior of an iron ring or cylinder, a number of radial magnets point to a common center. These, as well as the ring, are wound with wire. In the central space is a shaft which carries a series of armatures, the outwardly projecting ends of which are so arranged as, when reversed, to approximate closely to the extremities of the magnets. When the armatures are thus rapidly carried past the magnets, currents of electricity are induced in the wires surrounding said armatures. Instead of making the commutators with as many springs or brushes as there are insulated strips to connect their curbrushes as to lons and vice is provided in which all the strips which convey currents of like kinds are united in the commutator itself, and it is of like kinds are united in the commutator itself, and it is
only necessary to use the springs or brushes to collect the currents from all the armatures, no matter how many mag. nets or armatures may be employed. Only two springs or brushes are used, one being always in connection with one of the projecting pieces of one half the commutator, while the other is always in connection with the other half. Hence one transmits the positive and the other the negative currents. When the machine is set in motion, a current is produced which flows through the halves of the commutator then passes through wires to the coils which surround the mag nets, and through the coils surrounding the iron ring. This circuit, small at first, rapidly excites the magnets, producing the maximum effect. The current is then led through any desired circuit and is returned to the machine through a spring into one half of the commutator, then into the other, completing the circuit from the coils surrounding the armatures, and then back to said cores. The entire current generated in or by all the armature coils is passed through the magnet and ring coils, and none of the armatures are set apart for generating a current for excitation of the magnets.


There is, besides, a new and ingenious pole charger which prevents the currents heing changed during periods of rest, so that no preliminary examination of the currents is neces ary before at once setting the apparatus in operation. Four sizes of the machine are made, and one of medium dimensions is capable of running 200 gallons of nickel solution. The apparatus will be found at the Centennial, at west end of Corliss engine avenue, B 78. Patented by Ed ward Weston, July 18,1876. For further particulars address Condit, Hanson, \& Van Winkle, 236 Market street, Newark, N. J.

## oceanic birds.

The sub-family of web-footed oceanic birds known to zoölogists as the procellarince contains several genera, the best known of which are procellaria or petrel proper, and thalassidroma or stormy petrel. The name petrel is derived from Peter, in remembrance of the apostle's walking on the water, a characteristic of the bird excellently shown in the first of our 'two engravings. The birds here shown, commonly called by sailors Mother Carey's chickens, are readily distinguished from the common petrel by the shorter and slenderer bill. The species are about twelve in number, and inhabit the oceans of both hemispheres, skimming lightly over the waves or running along their tops; they are dark in color, but more or less marked with white. The Mother Carey's chicken (thalassidroma pelagica) is about six inches long in the body, with wings opening to a width of over thirteen inches; the bill and feet are black; the body is grayish, black above, tinged with brown. The presence of these birds is supposed by mariners to forebode stormy weather, and they are never molested by sailors, as their warnings are usually accepted in perfect faith; they are found all, across the Atlantic, especially in the temperate zone, and are common on the banks of Newfoundland. They breed on rocky shores and islands, in the North Atlantic. On the Shetland Isles, Scotland, they begin to lay toward the end of June, depositing a single egg in a nest made of plants and earth, which they carefully conceal, sometimes placing it three or four feet under a heap of stones. The naturalist Brünnich states that these birds become so fat that the inhabitants of the Faroe islands attach wicks to them and burn them as lamps.
Our second engraving represents another of the tireless wanderers of the deep, the albatross, also of a web-footed genus. Three species are known -the common albatross (diomeda exulans), the albatross of China (diomeda fuliginosa), and the yellow and black beaked albatross (diomeda chlororynchos). The first is the species chosen by the artist for representation; it is also called the man of war bird. The genus is distinguished principally by a very strong, hard, straight beak, which suddenly curves downwards, with a sharp hook at the point. The feet are short, the three toes long and completely webbed, the wings long and narrow. The common albatross is the largest sea bird known, weighing from twelve to twenty-eight lbs. Its wings measure, when extended, about eleven feet across; but a specimen, measuring seventeen and a half feet was shot off the Cape of Good Hope. The top of its head is of a ruddy gray, all the rest of its plumage, with the exception of some black bands on its back and a few wing feathers, being white. It is abundant from the Southern Ocean to as far north as Kamschatka, but scarcely ever visits our coasts. Its voracity is extreme, its ordinary food being fish and fish spawn: it can readily be caught, however with a strong line and a hook baited with a piece of fat pork. Its powers of flight are very remarkable; and its voice is harsh and disagreeable, resembling the braying of an ass. The albatross is regarded with superstitious awe by sailors; and the killing of one is believed to bring down disasters on the ship.

## Sugrestions about Breeding Cattle, etc.

 1. a perfect development and sound vigor ous health, constitutionally, especially in the generative organs, are conditions of fertility 2. In the maintenance and improvement of a breed, the truth that "like produces like," that the reproductive germ will stamp upon the animal developed from it the characters of the parent organisms, is the backbone of success.3. We can, in a great degree, at will, pro duce variations and improvements in breeds, as by abundant feeding, a mild and salubrious climate, a rich and healthy soil, moderate use, education, stimulation, or selection of desirable qualities; by disease or rejection of undesirable characters and properties; by soliciting the weight of imagination in our favor by allowing the breeding animals to mix only with those of the stamp desired; by crossing less improved breeds systematically with mates of a better race, and by crossing ani mals faulty or deficient in some particular point with others, in which this point is de veloped in excess.
4. The herding of pregnant high-class ani 4. The herding of pregnant high-class ani-
mals with low-bred ones, and the resulting attachment between the two races, are to be especially avoided, as occasionally affecting the progeny injuriously; strong impressions from a new or unusual condition of surrounding objects are to be equally guarded against.
5 If a valuable female is allowed to breed to an inferior male, she cannot be relied upon to produce pure-bred animals for several succeeding pregnancies. Through a strong and retained impression, through the absorption into the system of living particles (germinal matter) from the fæetus, or through some influence, during pregnancy, on the ova,
then being most actively developed, the good or bad features of the first sire are perpetuated in the progeny of succeedng ones.
5. All breeds show a tendency to breed back, or to produce offspring bearing the marks of their less improved and comparatively valueless ancestors; hence, individuals of this kind must be rejected from the best breeds if we would maintain their excellence.
6. Certain races and individuais have their characters more


THE STORMY PETREL.
fixed, and will transmit and perpetuate them in greater proportion than others with which they may be crossed. If their qualities are desirable, they prove highly valuable in raising other stock of greater excellence. If undesirable, they will depreciate the value of any stock crossed for many generations. That fixity of type, however, is, above all, a characteristic of those which have been carefully selected and bred up to a certain standard for many generations, so that, in our best, longest established, and most esteemed breeds, we have a most valuable legacy left us by the suc-


## THE ALBATROSS.

cessful breeders of the past, with which we may mold our inferior races almost at will.
8. While breeding continuously from the nearest relations tends to a weakened constitution, and the aggravation of any fusing the blood to sterility, these may be avoided by in has been bred apart from the branch of it for several gene-
rations. Moreover, the highest excellence is sometimes at tained only by breeding very close for a time
9. Diseased or mutilated animals are generally to be dis carded from breeding. Mutilations resulting from disease during pregnancy, and disease with a constitutional morbid taint are, above all, to be dreaded as transmissible.-Pro fessor James Lav.

Laying the First
New York and Brooklyn are at last joined to gether. The bond is a frail one at present, be ing only two $\frac{9}{4}$-inch wire ropes stretched from tower to tower of the future East River bridge but it is the beginning of the great superstruc ture, marking the first step in the second por tion of the enterprise, and the substantial com pletion of the vast stone monuments which form the foundation for the whole. The two cables, each 3,600 feet long, were made fast near the Brooklyn anchorage, drawn up over the top of the pier, and then lowered to a scow, which car ried the ends over to the New York side, the slack being paid into the river. A hemp rope leading from a drum on a small engine, and pre viously brought over the New York tower, was made fast to the end of one cable, which wa thus hauled over the pier until said end could be attached to a larger engine. The latter the hauled the cable taut and to an altitude of 180 feet above the river. The second cable was the raised in similar manner.
The work occupied five hours, and was wit nessed by a large number of people. The ca bles will next be stretched from the towers to the respective anchorages, and all will then be joined together to form an endless chain, by means of which the material used in the con struction of both the temporary and the perma nent bridges will be transported across the river
 Farmers, and Engineers.
The following are fair approximate rules for the power required to drive cotton machinery : Cotton openers, 1 horse power per $1,000 \mathrm{lbs}$. of cotton delivered ; cotton pickers, 3 horse power per 1,000 lbs. of cotton delivered; cotton cards $\frac{1}{2}$. horse power per lb. of cotton delivered per day, and, at 125 revolutions per minute, $0 \cdot 125$ horse power; railway heads, breakers, 1 horse power per each 10 yards per minute; railway heads, finishers, 0.001 horse power per revolution per minute; drawing frames, 0.002 horse power per revolution per minute; spindles, 0.005 horse power per spindle per 1,000 revolutions.
To find the safe pressure a cylindrical boiler will bear in lbs. per square inch: Divide the thickness of the plate in inches by the diameter of the boiler in inches, and multiply the quotient by 5,000 for a ccpper boiler wiih single riveted shell; by 6,400 for a copper boiler with double rivete shell; by 7,600 for a wrought iron boiler with single riveted shell; by 9,000 for a wrought iron boiler double riveted; by 10,000 for a steel boil er single riveted; by 12,000 for a steel boiler double riveted.
To determine the amount of coal in lbs which will be burned per square foot per hour with chimneys of good proportions, Professo Thurston's rule is to subtract 1 from twic the square root of the hight of the chimney To determine the hight of chinuney required to give a certain rate of combustion, add 1 to the weight to be burned per square foot per hour divide by 2 and square the quotient.
Pulleys covered with leather, iron pulleys polished, and mahogany pulleys polished, rank for working value as 36,24 , and 25 , respective ly, wood and iron uncovered being almost iden tical.
Iron castings shrink $\frac{1}{10}$ inch to the foot in cooling in the mold.
To find the weight of pipe per lineal foot in lbs., subtract the square of the inside diameter in inches from the square of the outside diameter in inches, and multiply for cast iron by $2 \cdot 45$, for wrought iron by $2 \cdot 64$, brass by $2 \cdot 82$, copper by $3 \cdot 03$, lead by 3.86 .
The natural slopes of earths, with horizon tal line, are as follows: Gravel (average) $40^{\circ}$ dry sand $38^{\circ}$, sand $22^{\circ}$, vegetable earth $28^{\circ}$ compact earth $50^{\circ}$, shingle $39^{\circ}$, rubble $45^{\circ}$, clay well drained $45^{\circ}$, clay wet $16^{\circ}$.
Sand weighs about 30 cwt . per cubic yard gravel the same; mud 25 cwt ., marl 26 cwt . clay 31 cwt ., sandstone 39 cwt ., shale 40 cwt . quartz 41 cwt ., granite 42 cwt ., trap the same, slate 43 cwt .
To true a carpenter's grindstone, use a $\frac{8}{4}$-inch bar of iron or a gas pipe, for a turning tool holding it below the center of the stone.
Chipping hammers should weigh about $1 \frac{1}{4}$ lbs. and have handles 15 inches long.
A 6 inch emery wheel should make about 2,400 revolu tions per minute, an 8 inch 1,800 , a 12 inch 1,200 .
The pressure in lbs. per square foot of water acting against a plane surface at rightangles to the direction of movement is 0.976 times the square of the velocity in feet per second

## BREECH-LOADING FIREARMS.

We herewith publish the second of a series of three classes of breech-loaders, the illustrations of which are selected from Mr. E. H. Knight's "American Mechanical Dictionary." The arms shown were recommended by the U. S. army commission in 1873
In the engravings, $R$, is the Springfield arm, having a breech block hinged to the upper edge of the barrel and swinging upward and forward. The indorsement of the board as the best, all things considered, entitles it to an honorable place in the series of examples. $R$ is a side view of the gun, with the breech block, $d$, thrown up; $a$ is the bottom of the receiver, $c$ the breech pin, with its circu lar recess to receive the cam latch,$f$, which locks the breech block in place; $g$ is the cam latch spring, $h$ is the firing pin which transmits the blow of the hammer to the priming of the cartridge, and is pressed back by a spiral spring after the delivery of the blow; $j$ is the cartridge shell ejector, $k$ its spring; $l$ an incline which tips up the ejected shell so as to throw it out of the receiver. $R^{1}$ is a top view of the gun with block closed. $R^{2}$ is a section with the the gun with block closed. $\mathrm{R}^{2}$ is a
breech block closed. The dotted lines breech block closed.
show the block raised.
show the block raised.
The breechblock is raisedupward and forward in the act of opening by a thumb piece, $m$, which releases it by turning up the cam latch out of its recess in the breech pin. When fully open, it discloses the chamber, or rear end of the barrel, ready for the insertion of the charge contained in a copper car tridge case, holding seventy grains of musket powder, and firing a bullet 45 musket powder, and firing a bullet $\frac{15}{100}$ of an inch in diameter and weighing about 400 grains. When the breech block is closed, it is held down an braced against thesffort of the heavies charges by the cam latch, which flie into place in closing. The piece is fired by the ordinary side lock taken from the old muzzle-loaders. In opening the piece after firing, the breech block strikes the lump on top of the extractor, and re volves it so as to carry the now empty cartridge shell to the rear. After pass ing a certain point, the spiral spring in front of the extractor is released, and ac celerates its motion, so that the cartridge is thrown sharply against the beveled surface of the ejector stud, by which it is deflected upward and expelled from the gun.

S $S^{\prime}$ are two views of the Elliot carbine recommended by the same board for trial in the field, as exhibiting "remarkable facility of manipulation in re quiring but one hand to work it." This arm has a breech block hinged to the breech pin and operated by the hammer. Fig. S shows the gun in loading position and $S^{\prime}$ in the position " ready to fire." After firing, the hammer, $d$, is pulled back to the position shown in $S$, and in so doing draws by the yoke, $b$, upon the breech block, $a$, to which it is pivoted a c. This pulls down the frontend of the breech block, exposing the rear of the barrel for the insertion of the cartridge Having done this work, the pin, $e$, of the yoke slips out of the socket, $f$, into the lower portion of the groove, while the lower branch of the yoke engages over the pin, $g$, so that, when the hammer is again pulled back, the breech block is pushed up again into the position shown at $S^{\prime}$, where the hammer is on full cock and the arm ready to fire; $h$ is a strap which works the retractor, so that the shell is ejected as the breech block is pulled down. $S$ shows the cartridge ejector pulled out; $S^{\prime \prime}$ shows it in its ejector pulled out; $\mathbf{S}^{\prime \prime}$ shows it in its bed. One pull on the hammer depresses the breech block and ejects the empty
shell; another pull closes the breech shell; another pull closes the breech
block and puts the hammer in position for firing; a pull on the trigger fires the arm.
T T' are two positions of the Ward-Burton gun, which is on the bolt principle, like the Prussian needle gun and the French Chassepot. This gun, in its magazine form, was also recommended "for farther trial in the field." This gun, having been fired, is opened by raising the handle, $a$, of the bolt and withdrawing it directly rearward; the position is shown in Fig. $\mathrm{T}^{\prime}$ in the engraving. As the cartridge shell is pulled out by the spring hook on the upper edge of its flanged rim, the pin which rests against its lower portion comes in contact with the front end of the trigger pin, which tips it up and throws it out of the receiver. Another car tridge is then introduced by hand or by automatic devices from the magazine, and pushed into the bore of the gun by the longitudinal forward motion of the bolt. Near the head of the bolt is seen a part of the sectional screw which engages with a corresponding section within the gun when the piece is closed, and the handle turned down into place, so as to support the bolt against the force of the discharge. $\rightarrow$ Published in

The firing pin is an axial spring pin released from the bolt by a downward pull by means of the trigger and lever. Fig. T is the position "ready to fire," the driving spring being condensed and ready to act. Fig. $T^{\prime \prime}$ shows the bolt withdrawn and the cartridge tumbling out. When the bolt is withdrawn, the sleeve of the firing pin is so far retracted hat a shoulder catches behind the trigger. When the bolt is pushed home, driving the cartridge into the barrel, it leaves the shoulder of the firing pin resting against the trigger, as shown in Fig T

## Astronomical Photography.

The facility and precision with which photography repre sents luminous phenomena in their miuute details render his application of optics more and more important in the sciences of observation, and especially astronomy. But photography could not take a regular place in observatories unless the photographic apparatus had the same simplicity and theoretical perfection as the instruments used for cur ent observations M. Cornu states, in a note to the Paris cademy, that, having had occasion to study this problem


## BREECH-LOADING FIREARMS.

in connection with the transit observations, and later at the request of the Council of the Paris Observatory, he has found a solution of it as complete as possible. The negatives he had to lay before the Academy would, he trusted, justify this opinion.
It is the peculiarity of this method that it does not re quire any special instrument, any telescope, and may at once be adopted for photographical observations by means of a purely mechanical arrangement, which does not at all affect the optical qualities of the instrument ; the two lenses which compose the objective have merely to be separated to an extent depending on the nature of the glasses, but rarely exceeding $1 \frac{1}{2}$ per cent of the focal distance. This operation shortens this distance about 6 to 8 per cent. Theory and experience prove that the original achromatism of the visible rays is transformed into achromatism of the chemical rays, which is necessary to the perfection of photographic images. Direct and precise measurement has shown that this slight separation of the glasses does not cause any aberration in the images.

This method has succeeded perfectly at the Paris Observa ory with the large equatorial of the eastern tower, the objective of which is 14.934 inches in aperture, and $29 \cdot 13$ feet n focal distance. By a very simple arrangement the glasses can be separated, and the instrument may be employed for optical as well as for photographic observations. The photographic adjustment does not present any inconvenience in observation of faint stars. M. Cornu states that he easily observed Uranus, and at least one of his satellites, without finding it necessary to re-establish optical achromatism.
At the principal focus of this instrument are obtained direct photographic images of the sun and of the moon, measuring nearly 3.42 inches in diameter : images which might be easily magnifigd by means of the eyepiece so as to give negatives of more than 39 inches in diameter. The images hus enlarged gain, perhaps, in artistic effect, but they lose n distinctness.

## Alcoholic Solution of Shellac.

The production of a clear alcoholic solution of shellac has been the subject of numerous experiments, but hitherto none has turned out satisfactory except slow filtration. As is known, by digestion of one part of shellac with six or seven parts of 70 per cent alcobol, a solution is obtained which, when warm, is almost clear, but upon cooling becomes turbid, and is only partially clear after standing a week. The plan of pouring sufficient alcohol over coarsely powdered shellac to form a thin paste, yields, upon the addition of more alcohol after the lapse of eight or ten hours, a liquor that does not deposit any more, but which is not clear. Another method suggested, of boiling the alcoholic shellac so ted, of boiling the alcoholic shellac so
lution with animal charcoal, gives a lution with animal charcoal, gives a
clearer liquid, but there is always loss through absorption by the animal charcoal.
The object sought by the author was to obtain a clear alcoholic solution in a short time without much loss. Previous communications upon the substance occurring in shellac to the $\mathrm{e} \dot{x}$ tent of five per cent, which renders its alcoholic solutions turbid, and is described by some authors as wax, and by others as a fat acid, suggested an by others as a fat acid, suggested an attempt to effect its removal before dis-
solving the shellac. The shellac, theresolving the shellac. The shellac, there-
fore, was boiled with water, from one fore, was boiled with water, from one
to five per cent of soda or ammonia beto five per cent of soda or ammonia be-
ing added, but without satisfactory result; a somewhat larger addition of the alkali caused the solution of the shellac. The author next prepared a solution with one part of shellac and six parts of 90 per cent alcohol at the or dinary temperature, which was effect ed with frequent shaking in ten or twelve hours. To this he added carbonate of magnesia to about half the weight of the shellac used, and heated weight of the shellac used, and heated
the mixture to $140^{\circ}$ Fah. The soluthe mixture to $140^{\circ}$ Fah. The solu-
tion so obtained cleared more rapidly tion so obtained cleared more rapidly
than a solution to which magnesia had than a solution to which magnesia had
not been added, and filtered in less time; but it did not supply what was sought. When powdered chalk was substituted for magnesia, the solution, after standing some hours, became three fourths clear, while the lower turbid portion could be rapidly filtered. It only required a little alcohol to wash the filter, and a clear alcoholic solution of shellac was obtained. Further experiments, for instance with sulphate of ments, for instance wive a better result baryta, did not give a better result. When such a solution is made on a large scale it would be best filtered
through felt. through felt.
Notwithstanding that the object of the author had thus been attained, one or two other experiments were tried. To three parts of the above mentioned shellac solution one part of petroleum ether was added, and the mixture was vigorously shaken. After standing a few moments the liquid separated in two layers; the upper light colored layer was the petroleum ether with the wax dissolved in it, the lower yellow brown layer was a clear solution of shellac with only a little petroleum ether adhering. Upon allowing the petroleum ether to evaporate spontaneously the wax that had been dissolved out of the shellac was obtained as a white residuum. By using alcohol at 95 per cent to dissolve the shellac, and then adding peat 95 per cent to dissolve the shellac, and then adding pe-
troleum ether, a perfectly clear solution was obtained that troleum ether, a perfectly clear solution was obtained that only separated into two layers after water was added. Con-
sequently an alcohol weaker than 90 per cent should be used. sequently an alcohol weaker than 90 per cent should be used.
The shellac solution obtained by means of petroleum ethThe shellac solution obtained by means of petroleum eth-
er, however, has the advantage that the shellac is. left, afer, however, has the advantage that the shellac is. left, af
ter evaporation, in a coarser form, and easily separates; this may be obviated by adding one to three per cent of Venice turpentine.-A. Peltz, in Pharmaceutische Zeitschrift für Russland.

## the tapayaxin.

Mr. F. W. Fanning, of Corsicana, Texas, has forwarded us a specimen of the crowned tapayaxin or horned lizard (phrynosoma cornutum). This curious reptile is not uncommon in the South and in California, and is stated to be very lively when at liberty, pursuing its prey with much eagerness. In confinement, however, it becomes almost torpid, remaining for some hours in the same attitude. In spite of its formidable looks, it is perfectly harmless, and can be taught to eat flies from its owner's hand. Red ants are its $f_{\text {avorite }}$ food; but it will eat insects of all kinds. Its general color is gray, one variety (phrynosoma Blainvilii) being variegated with irregular bands of brown. This animal is sometimes erroneously called the horned frog and horned someti.
Mr. Frank Buckland describes a specimen in his collection as follows: "My new friend is about the size of a common sized toad, and at a distance off looks very like one. He is covered all over with spines, some of which are larger and stronger than others; he has two fixed spines, one over each eye, and three fixed spines on each side of his face. At the top of his head are situated the two biggest spines, each about half an inch long, giving him a most diabolical appearance All the spines are fixed firmly into his head. As will be seen by the picture, his body is covered with spines of different sizes, and set into his skin very thickly. The consistence of the spines reminds me much of the spines of the blackminds me much of the spines of the black-
thorn. The color of the animal is gray, varied with brown and ochrey yellow; in fact it ried with brown and ochrey yellow; in fact it
is very like the color of the bark of an old ree."
The tapayaxin sent.us by Mr. Fanning has remained very quiescent since his arrival, hardly deigning to notice the flies placed in his box for his sustenance. He is apparently in good health, and his reticence of speech may be attributed to his philosophical temperament, and perhaps to some provincial bashfulness, natural to a new comer to the metropolis.

Lightning Conductors.
Dr. Mann lately showed, at the Science Conference at South Kensington. how unimportant is the form of lightning conductors, whether rods, ropes, or pipes; and that the real desideratum was that they should be of sufficient size to afford an unobstructed path for the passage of the electric fluid. He insisted on the necessity of a goodly number of points, and above all upon the indispensability of large earth contact, saying that a lightning discharge passing through a large rod with an ample earth contact is only a gentle stream of low tension; but that, if the size of the rod or the area of its contact with the earth is diminished, the tension is increased, and the tluid has a dangerous tendency to discharge itself laterally by chance outlets.

## IMPROVED DOOR KNOB.

The chief failing of the ordinary door knob is that it The loose. Sometimes this occurs from the wood of the door not being properly seasoned, and hence shrinking, and frequently from the device itself not being secured to the woodwork as tightly as it should be. The above difficulty is claimed to be completely remedied in the improved knob illustrated in our engraving. The roses are secured to the door by little points on the underside. There is but one screw, which is attached to one of the knobs, and passes through the square rod. This is regulated, as shown, by a small catch pushed by a spring into a notch. As this notch represents an adjustment of but the one hundredth part of an inch, it is easy to see how well the knob can be made to fit. In mineral and porcelain knobs, the necks are secured by spurs going down in grooves and turning under the material of the knob.
The device is strong, easily adjusted, applied, or removed, simple and suitable for all kinds of knobs or latches. Further information may be obtained by addressing the Parker \& Whipple Company, West Meriden, Conn., or 97 Chambers street, New York.

## Mechanical Photo-Printing.

The following practical directions for mechanical photo rinting are from the text of Herr Husnik:
Use for the supports some plates of glass one quarter of an inch or less in thickness, roughened on one side by means of very fine emery and water, and applied by friction from another and smaller piece of glass to which a handle is attached. Do not allow the emery to become dry, or it will produce deep scratches. A circular motion should be adopted, using considerable pressure, and in about twelve minutes a very fine grain will be obtained. If plates be employed that have been previously used, remove the gelatin by immersing in a vessel containing a solution of soda. This wash keeps more than two months, and it is always possible to strengthen it by the addition of lime. The gelatin, in the case of a plate that has been previously used, will detail itself in about twelve hours. Rinse the surface and rub with emery to remove the gelatin that may have lodged in the pores; but this time one application of the emery will suf-
fice. The glasses thus prepared are washed in several fice. The glasses thus prepared are washed
First: Preparation of the plates.-Take fresh albumen 25
parts, distilled water 45 parts, silicate of soda 8 parts. Mix parts, distilled water 45 parts, silicate of soda 8 parts. Mix
well together, beatto a froth, and allow to stand for several well together, beat to a froth, and allow to stand for several
hours; then decant the clear part and filter it two or three times so as to ensure its being free from impurities.
In preparing the plates, place them, ground side uppermost, on a large slab of glass carefully leveled; and having brushed them over with a soft brush to remove all dust, pour a little of the preceding liquid near one edge, and cause it to flow over the surface by slightly inclining the large slab. If the liquid do not flow over the glass easily, it can be helped on by using a small slip of paper, takiug care that it does not run too fast. Now raise one of the corners so as to allow the superfluous liquid to flow off the plates into a receptacle placed beneath; and if there be any air bubbles on
the glass, pour some of the solution over it again while the


THE TAPAYAXIN OR HORNED LIZARD
lass is in an inclined position, leaving it thus to dry. The superfluous liquid can be filtered and used again. A great number of plates may be prepared in this way and kept for about six months; but it is better not to use them on the day on which they are prepared, as they improve by keeping.
In order to coat the plates with gelatin, they ought first to be carefully washed with cold water, taking care not to injure the prepared side. Let them stand upright until dry, after which they are ready to receive the gelatin, which is done in the following manner: Provide a case with a bottom of sheet iron and a curtain for the top; and in the interior, about two and three quarter inches from the bottom, rior, about two and three quarter inches from the bottom,
place a frame, upon which stretch calico or filtering paper, so as to diffuse and equalize the heat, which is obtained from a spirit lamp. About two and three quarter inches or so from the top, bars of iron with leveling screws are placed horizontally. A thermometer, with the bulb inside and tube and scale outside, fastened at the side, indicates the temperature of the interior. Place two, three, or more of the plates on the leveling screws, laying them in a horizontal position; shut the case and heat to $110^{\circ} \mathrm{Fah}$.
During this time put 15 parts of the finest French gelatin in 300 parts of distilled water, and leave it to soak for about an hour, after which dissolve in the water bath. Next, heat to a high temperature, and add 1 part of bichromate of am-


## WHIPPLE'S DOOR KNOB.

monia and 1 part chloride of calcium; when these are all dis solved, add 60 parts of ordinary alcohol, after which filter. This solution is poured upon the heated plates, and must be spread by means of a small slip of paper. Experience regulates the proper quantity to be applied, and a considerable degree of dexterity will be required; but this is easily attained. Care must be taken to prevent the layer from being either too thick or too thin. The plates thus coated are placed in the case to dry at the temperature of $110^{\circ}$ Fah., and after being well dried, they will keep in summer for about eight days, and in winter about four weeks, in a dark
place; they improve by keeping. Exposure-Wrove by keeping.
Exposure.-With a good negative in the shade an exposure from fifteen to forty-five minutes will be required, according to the intensity of the light-diffused light giving the best half tints. After exposing, the bichromate not acted upon by the light is removed by being washed with water, and the plate is then well drained and dried. In about three hours it is ready to be printed from.
Printing.-The plate is attached, by means of plaster of Paris, to a lithographic stone, and submitted to the action of a lithographic press. Damp the plate and ink it with two kinds of ink, one stronger than the other. After obtaining
a print the plate is moistened, wiped with a cloth and inked

If the details in the shadows be not properly brought out,
put extrapressure on that part. One plate will furnish a put extra pressure on that part. One plate will furnish a
considerable number of proofs, provided the instructions be considerable number of proofs, provided the instruction
carefully carried out and the gelatin be of good quality.
Final observation. This method, according to Herr Hisnik's experience, is the best in use, and it gives certain results Some photographers substitute isinglass for a portion of the gelatin, but this substance can rarely be obtained of good quality.
The choice of the inks is very important. Munich varnish ought not to be used for black, as it attacks the gelatin and the plate loses its vigor. Good black printing ink answers better when mixed with red oxide of iron, and a little César varnish imparts a good brown tint.

## Utilization of Waste.

Cotton waste is a singular example of the successful application of scientific utilization. It is the collected sweepings of the card room, and formerly had no value. Large heaps were suffered to accumulate until it fermented, and was then spread over the land. After that, cartridge paper makers bought it at $\$ 10$ to $\$ 20$ per tun; then it rose in price, and means were found to bleach and tear it up, in order that it might be respun and woven, and now there is a trade of $14,000,000 \mathrm{cwts}$., giving employment to 500 dealers. The various use are all exhibited, and the refuse is then sold for engine cleaning, and finally to the paper maker; jute is next. An immense trade has been maker; jute is next. Animmense trade has been
created. It is a product of Bengal, and forcreated. It is a product of Bengal, and for-
merly was used only for gunny bags, to pack merly was used only for gunny bags, to pack
rags or merchandise in, but now it yields to rags or merchandise in, but now it yields to
processes which fit it for weaving with silk processes which fit it for weaving with silk
or cotton, or in the making of thread, ropes, sail cloth, and with wool in flannels and carpet, and with cocoa nut fiber for matting, etc. During 25 years the con sumption has risen from $391,000 \mathrm{cwts}$. to $1,250,000 \mathrm{cwts}$. and the value from $\$ 450,000$ to $\$ 5,000,000$, and the re fuse now equals the original import of the raw mate. fuse
rial.

## Failures-- What thev Teach.

The numerous failures and suspensions which have made the commercial world, since the panic of 1873 , one of constant upheaval and change, should be utilized, by those for tunate ones who have thus far escaped disaster and by those who are entering, for the first time, the field of business life for the lessons that may be drawn from them. Failures, like every species of mishap, only follow from a sufficient cause ; and usually it is one that could have easily been counteracted or avoided if the fact of its existence had not been unknown. And it is just here that we find so many of our business men weak. In their acquaintance with their own business, they lack that complete command, of the call ing they have professedly made themselves master of, which alone enables one to understand and avoid its dangerous points.
The man who makes a study of or who devotes time to an ccurate and scientific education in the business he has chosen, as a means for the accumulation of wealth, is now rarely found ; and it seems to us that a large number of the failures of the last three years might justly be attributed to this cause. The idea seems to prevail that a business transacted on one's own account is a kind of perpetual motion, that, once started, will not only keep itself in operation, but may be drawn upon to an almost unlimited extent for the means to sus tain other enterprises. The inventor who spends years in attempting to realize his impossible machine is not more certain of failure than he who starts in business with such expectation. The time when money could be made by ignoramuses, and when wealth could be had almost for the taking, has faded far away into the dim past ; and an era of strife and struggle has dawned, in which only those who have struggle has dawned, in which only those who have
most carefully prepared themselves for the warfare most carefully prepa
It is not luck that makes one man fail and his neighbor succeed ; it is not fickle fortune that brings clouds of difficulties upon one while another has ap parently plain sailing; it is something far more certain in its operations than either of these. It is skill and a perfect com mand of his resources that enables one man to advance where another can make no progress; and these two qualities are possessed only by those who have made their busi ness the one thing they must become perfectly familiar with. The world is not yet so crowded that any need go to the wall to support the rest ; there is room for all, and an abundance to spare. The great want is for more men who are well qualified for work and who will put their shoulders to the wheel and push. Any person who is determined to win, the wheel and push. Any person who is determined to win,
and who unites with his perseverance sense enough to know that success comes only to those who deserve it, by the pathat success comes only to those who deserve it, by the patience and skill with which they toil, has before him an in-
viting field for labor, and may enter it with the assurance viting field for labor, and may enter it with the assurance
that, if his efforte are rightly directed, they will meet with a sure reward. - Northwestern Lumberman.

Filters for waterworks may be calculated for as follows square yard of filter for each 700 gallons in 24 hours, formed of 2 feet 6 inches fine sand, then 6 inches common sand, 6 inches shells, and lastly 2 feet 6 inches of gravel Perforated pipes should be laid in the lowest stratum, to carry off the supply of filtered water.

Illumination of Lighthouses.
M. E. Allard, engineer-in-chief of the Administration of M. E. Allard, engineer-in-chief of the Administration of
Lighthouses, has lately brought before the Paris Academy Lighthouses, has lately brought before the Paris Academy
of Sciences some papers on the illuminating power of the flames employed for illumination, their transparency, and the translucency of the atmosphere. The first paper treated on the transparency of flames. The burners used in lighthouses have diameters of from 1 to 5 inches, and carry from 1 to 6 concentric wicks. In measuring the luminous intensity of the flames which they produce, it is found that these intensities increase a little less rapidly than the consumption of oil, and also that the intensity for each $\frac{1}{3}$ of a square inch of apparent surface increases, while, on the contrary, the intensity for each $\frac{1}{16}$ of a cubic inch of volume diminishes in direct proportion to the diameter. These results can only be explained by admitting that the transparency of the flame is not absolute.
This is the object of the first investigation made by M. Allard; he has determined the co-efficient of this transparency by three series of experiments: by measuring the intensity of different flames with a flat wick looked at sidewise or edgewise; by means of a curved mirror, which reflects towards the focus the rays which it receives, and thus causes them to pass through the flame; and by measuring the intensity of an electric l:ght across a flame of large diameter. These investigations have led to the adoption of the number $0 \cdot 8$, as a mean value of this co-efficient reduced to a thickness of $0 \cdot 39$ inch in the flame passed through. One important conclusion is arrived at, namely, that the total quantity of light produced, or the absolute intensity, increases much more rapidly than the weight of oil consumed; but as the quantity of light absorbed, by the passage of the rays across he flame itself, increases in a still greater proportion, the difference between these two quantities, or the effective intensity, follows a law of augmentation a little less rapid than the consumption of oil.
M. Allard was next engaged on the translucency of the atmosphere. The ofservations made by lighthouse keepers on the visibility of neighboring lights consisted in noticing, three times each night, whether each of the lights could or could not be perceived, so that it might be ascertained, at the end of a certain number of years, how nany times out of a hundred each of these lights was visible. A diagram showed, for each of the lights noticed, what is the gram showed, for each of the lights noticed, what is the
limit of translucency in which it ceases to be perceived from limit of translucency in wh of observation.
the place of observation.
In another paper M. Allard has studied the impressions In another paper M. Allard has studied the impressions
produced on the organ of sight by flashing lights. It approduced on the organ of sight by flashing lights. It ap-
pears that, by causing a series of flashes to be succeeded by equal intervals of darkness, each flash at moderate speed produces the same effects as if in an isolated state; in proportion as the speed increases, the impression on the retina is prolonged, and after a certain speed the effect is that of a constant light

## Volatilized Gold,

General Howston lately donated to the Microscopal Society of San Francisco a slide mounted with volatilized gold, which, under a $\frac{2}{3}$ objective, opaque, was not only a beautiful but instructive object. The microscopic globules were perfect in shape, and were obtained at some distance from the melting pot, from which they had been thrown off by the draft and heat in a volatile form, so to speak, and condensed in the air in the form of minute shot, forming a veritable shower of golden rain. With all the care and appliances for the prevention of wastage in smelting or refining gold, a portion is lost in this way; and no doubt the roofs of the houses adjacent to mints and refineries would yield enough of the precious metal to show the color, at least, under the microscope.

## Hiring Horses.

It has been decided, says the Turf, Field, and Farm, that when a horse or carriage is let out for hire, for the purpose of performing a particular journey, the party letting warrants the horse and carriage fit and competent for such journey. If the hirer treats the horse or carriage as any prudent man would do, he is not answerable for any damage either may receive. But he must use the horse for the purpose for which he hired him. For instance, a horse hired for saddle must not be used in harness. If the hirer violates damage that may occur. If the horse is stolen through the hirer's negligence, such as leaving the stable door open all night, he must answer for it. But if he is robbed of it by night, he must answer for it. But if he is robbed of it by highwaymen, when traveling the usual road at usual hours,
he cannot be held for damages. As these questions are frehe cannot be held for damages. As these questions are fre-
quently in dispute, it is not out of place to shed a little light upon them.

## Comparative Photographs of Blood

The American Naturalist states that Dr. J. G. Richard son, for the sake of illustrating in criminal cases the distinguishable appearances of different kinds of blood, has flowed drops of blood from different animals so nearly in contact on the glass slide that portions of the two drops appear in the
same field, and can be photographed together. Dr. C. Leo same field, and can be photographed together. Dr. C. Leo
Mees has modified this method, and obtained exquisite reMees has modified this method, and obtained exquisite re-
sults in specimens presented to the microscopical section of the Tyndall Association. He spreads the blood by Dr. Christopher Johnston's method, which is to touch a drop of blood to the accurately ground edge of a slide, and then draw it gently across the face of another slide, leaving a beautiful ly spread film. In this way one kind of blood is spread upon the slide and another on the cover. When dry, one half of
each is carefully scraped off with a smoothly sharpened each is carefully scraped off with a smoothly sharpened
knife, and the cover inverted upon the slide in such posi-
tion as to bring the remaining portions of the film into apposition. Under the microscope and in the photograph the two kinds of blood appear in remarkably fine contrast, even
those bloods that are too nearly alike for safe discrimination those bloods that are too nearly alike for safe discrimination
in criminal cases being easily distinguished when thus prepared from fresh material.

## Musical Sand.

Mr. Frink states in the "Proceedings of the California Mr. Frink states in the "Proceedings of the California Academy of Sciences," that, in order to ascertain, if possi-
ble, " the cause of the sound that is produced by the sand ble, " the cause of the sound that is produced by the sand
from Kauai, presented to the Academy at a former meeting, I investigated its structure under the microscope, and I think the facts I have ascertained fully explain the manner in which the sound is produced. As the grains of sand, although small, are quite opaque, it was necessary to prepare them so that they should be sufficiently transparent to render their structure visible. This was effected by fastening them to a glass slide and grinding them down until one flat surface was obtained. This surface was then attached to another slide; and the original slide being removed, the sand was again ground down until sufficiently transparent. The grains were found to be chiefly composed of small portions of coral and apparently calcareous sponges, and presented under the microscope a most interesting object. They were all more or less perforated with small holes, in some in stances forming tubes, but mostly terminating in blind cav ities, which were frequently enlarged in the interior of the grains, communicating with the surface by a small opening. A few foraminiferce were also met with, and two or three pecimens of what appeared to be a minute bivalve shell. Besides these elements, evidently derived from living beings, the sand contained small black particles, which the microscope showed to be formed principally of crystals of augite, nepheline, and magnetic oxide of iron, imbedded in a glassy matrix. These were undoubtedly volcanic sands. The structure of these grains, I think, explains the reason why sound is emitted when they are set in motion. The friction against each other causes vibrations in their substance, and consequently in the sides of the cavities they contain; and these vibrations being communicated to the air in the cavities, under the most favorable conditions for producing sound, the result is the loud noise which is caused when any large mass of sand is set in motion. We have, in fact, millions upon millions of resonant cavities, each giving out sound which may well swell up to resemble a peal of thunder, with which it has been compared; and the comparison-I know from others who have heard it-is not exaggerated. The effect of rain in preventing the sound is owing to the cavities in the sand becoming filled with wat and thus rendered incapable of originating vibrations."

## Another Opportunity for inventors.

An interesting competition is about to be opened by the German society Verein von Gas and Wasser Fachmännern Deutschlands, which offers a prize of $\$ 400$ to the author of the process for the economical purification, from carbonic acid, of illuminating gas obtained from coal. The systems now commonly employed involve either hydrate of lime, certain salts, muriate of manganese for example, and iron oxides. Whether these methods leave more or less to be desired according to thenature of the coal distilled, or whether the forms of purifiers are imperfect, it is nevertheless certain that carbonic acid still remains present in illumina ting gas, and its presence is decidedly unhealthy. Either a new system for its complete removal, or an effective im provement on the older processes, is required. The inven-
tion must be economical, easy of manipulation, and must not lower the illuminating power of the gas. The memoir describing it must be complete, and explain both the theory and the practice. Manuscripts must be signed with some distinctive device, which is to correspond with a similar mark on a sealed packet in which is written the name and address of the author. Communications are to be addressed nich, prior to December 31, 1876

## Microscopic Ruled Test Plates.

The finest lines I have succeeded in ruling are about 60000 of an inch in width. These values are substantially the same as those given by Dr. Royston-Pigott, as represent ing the ultimate limit of visibility under the microscope. The smallest angle at which an object can be distinctly seen is stated by him to be $6^{\prime \prime}$, while other writers place it as high as $60^{\prime \prime}$, or even $120^{\prime \prime}$. Even the smallest value named a single line, ${ }_{30} \frac{1}{0} 00$ of an inch in breadth, which can be a single line, $\frac{\pi \overline{0} \overline{0} \sigma}{}$ of an inch in breadth, which can be
seen at the distance of seven inches from the eye. This corresponds to an angle of about $1^{\prime \prime}$. In this case the line is filled with plumbago; but if reflected from a silvered surace, it can be easily seen at the distance of eleven inches rom the eye. Comparing minute particles of matter which can be seen under a Tolles' ${ }^{1} 10$ objective with those which
can be measured, in the way indicated above, there is every can be measured, in the way indicated above, there is every
reason to suppose that the limit of visibility falls beyond $\frac{1}{40000}$ of an inch. It is quite possible that the conclusion reached by Sorby, that the microscope has already reached the limit of its power in separating lines whose distance apart is equal to one half of a wave length,may be found to be justified by futnre observations. It is certain that no lines beyond Nobert's 19th band have ever been resolved. The great difficulty in distinguishing true from spurious lines has caused more than one skillful microscopist to doubt whether the resolution has been certainly carried as far a hai point. But that light is 'of too coarse a nature' to
nable us to see particles of matter, as small as $\frac{1}{200^{1}} \overline{00}$ of an inch, is a conclusion which can be ref
slightest difficulty."-William A. Rogers.

Ventilation of Railway Tunnels.-Mr. G. J. Morison says that, when tunnels without shafts are to be ventilated, fans should be employed to keep up an artificial ventilation that for a given amount of traffic the power required to ventilatelong tunnels varies as the fourth power of the length; that when a long tunnel is to be ventilated it is more advantageous to have a double line tunnel with trains in each direction than two single line tunnels with trains in one direction only ; that for every tunnel there is a limit to the amount of traffic, where locomotives are used, beyond which ventilation becomes impossible : this limit cannot be very definitely fixed, but for a tunnel of twenty-two miles it does not exceed a total of twenty trains a day.

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Inventions Patented in England by Americans.
    [Compiled from the Commissioners of Patents' Journal.]
        From July }4\mathrm{ to July 28, 1876, inclusive.
Acoustic Telegraph.-T. A. Edison, Menlo Park, N. J
Axle Box and Oiler.-J. N. Smith, Jersey City, N. J.
Battery.-J. Byrne, Brooklyn, N. Y.
Boiler.-V. D. Anderson, Washington, D. C.
Bottle Stopper, etc.-S. S. Newton, Binghamton, N. Y
Cartridge Primer, etc.-E. Remington & Sons, IHon, N. Y. 
Cleaning Cotton, etc.-R. Kitson, Lowell, Mass.
Copying Press.-W. B. Sargent, New York clty, et al.
Driving Chain.-W. D. Ewart, Chicago, Ill.
Envelupr Maching.-M. S. Chapman, Hartford, Conn
Fold Metre.-W. Smith, San Francisco, Cal.
Folding Paper.-S. D. Tucker, New York city
Lubricator.-T. F. Stevenson, New York city
LOBRICATOR.-T. F. Stevenson, New Yo.
Oll STove.-O. Edwards, Northampton, Mass.
Paper Material.-W. F. Nast (of New York city), London, England.
Papre Material.-W. F. Nast (of New York c
lol
lol
PrepARING ChiNA Grass, etc.-J. B. Vogel et 
Scotring Leather, etc.-F. A. Lockwood, Fall River, Masb,
Sharpining Saws.-W. L. Covel, Providence, R. I. 
Spinning Machinkry.-T. Mayor, Providence, R,
Trangmitting Power.-J.Good, Brooklyn, N. Y
WASHING BARRELS, ETC.-G. Schock, New York clty
Watch Esoapement.-F. H. Volgt, Buffalo,
Watch Ket.-J. S. Birch, New York city.
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## Zerent gutctical and forcign zedatents.

## NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

improved releasing device for stables.
Arthur Chapman, Doylestown, Pa.-This invention consists of a and is hinged thereto, having slightly curved fingers or hooks, that retain rings, to which the cattle are fastened. A crank at tached to the rod at the outside of the building operates the rod and releases all the rings when turning the same.

IMPROVED SNAP HOOK.
Newton E.Cissna, Sioux Falls, Dakota Ter.-This is an improved snap hook for connecting the various straps, rings, and other parts of a harness, by which the straps may be readily taken ou and inserted, and securely and reliably retained therein. When the tongue is swung in outward direction to be at right angles
with the hook, the strap, ring, or other article is introduced, and by carrying the tongue back on the hook, firmly retained therein. The draft on the tongue causes the closing of the same, and secures the locking of the snap hook.

IMPROVED STREET LAMP.
John S. Woods, Brookline, Mass.-This consists of a duplex reflecting lamp, in which an oil holder is located between two burners, both of which are supplied from it, and it serves for the support of reflectors for the burners, to throw the light in opposite directions along a street.

IMPROVED GALVANIZING MACHINE.
George R. Acheson, Philadelphia, Pa.-This invention consists of a machine with rollers for tightening the wire cloth while passing through the galvanizing or painting liquid. Suitable
skimmers and beaters are arranged in connection with the cloth skimmers and beaters are arranged in connection with the cloth
at both sides of the same, to secure the regular tinning or painting. A sectional and diagonally jointed winding-up roller serves for being readily taken out of the cloth.
improved photographic picture case.
Thomas F. Adams, New York city.-This is a case with hinged and closed with the frame-carrying board is hinged, to be opened ble spring bolts. The supporting board carries a number of phc tograph frames, so hinged to intermediate pieces that any one may be readily swung to either side for the inspection of the pho tographs.
improved lime kiln.
Daniel G. Farrell and Andrew T. Lien, Mason City, Iowa, assignors to Farrell, White, \& Lien, same place.-The object here is to af-
ford a better application of the fire to the limestone than in kilns ford a better application of the fre to the limestone than in kilns constructed in the usual way; to make the kiln airtight, even
should it crack; to avoid the use of heavy timber and rods for tying the kiln; to cause the lime to drop evenly to the center o the draw; to avoid the necessity of drawing the lime while at a white or red heat, and to enable the lime to be dropped readily and surely. The invention consists in providing the kiln with a case and filling the space between them with clay, to render the
kiln airtight, even in case it should crack in consequence of the kiln airtight, even in case it should crack in consequence of the
effect of excessive heat. The invention further relates to a device for dislodging the lime and causing it to drop into the hopper. improved lattice piers for timber truss bridgas Lewis Scott, Brighton, Mich.-In this invention ${ }^{+}$wo sets of posts are so arranged in a truss brige that they will incline is opposit all sustained upon a common base, that is thus connected with a superposed beam, so as to form a re-inforcement brace or suppor to each other. This has the effect of dividing and evenly distribu ting the weight or strain along the whole length of the foundation r base.

## improved bridle bit attachment.

Thomas M. Allen, Augusta, Ky.-This is an improved attachment bridie bit for driving hard-mouthed horses with great faci-1ity; and it consists of the driving lines being passed through a
small pulley at the end of the bridle bit, and back through a loop in the saddle, and then downward to the shaft.
improved combined putty knife and screw driver. Charles Collins Bartlett, Medford, Mass.-This consists in com-
bining a putty knife and screw driver in one implenent, securing bining a putty k kife and screw driver in one implement, securing
the sliding and spring-acted screw driver to the handle when not the slidi
William E. Buckman, Easton PENTAL FLASK.
Wh, Buckman, Easton, Pa.-This is an improved dental flask,which shall be so constructed that it may be readily emptied of the plaster without danger of breaking the teeth. By suitable
construction, after the molding or hardening of the celluloid or construction, after the molding or hardening of the celluloid or
other material has been completed, the few taps required to separate the parts of the flask crack the plaster in such a way that it rate the parts of the task crack tee paster of breaking them, so
falls away from the teeth without danger of but
that the plaster and teeth are readily removed from the flask and that the plaster and teeth are readily removed from the flask and
separated from each other. separated from each other.

## improved thimble.

Gilbert H. Finger, New York citt.-This invention consists in a thimble made with a concave top, and with concave surfaces, one
or more, upon its sides. The tops are made thicker than the sides. or more, upon its sides. The tops are made thicker than the sides.
The object is to prevent the eye of the needle, while being used, The object is to prevent the eye of the needle, while being used,
from slipping from the thimble and injuring the fingers of the from slipp
operator.
mproved soap re-melter.
Janiel Whitaker, Boston, Mass.-The object of this invention is, to provide a vessel for re-melting the scraps or fillings of soap
produced by the cutting up of the soap into bars while in the soap produced by the cutting up of the soap into bars while in the soap
frames, whereby the said scraps are utilized by being re-embodied inta a solidi homogeneous mass, without burning or decomposing.
It consists mainly in constructing a pot or cauldron with an open Into a sold homogeneonstructing a pot or cauldron with an open
It consists mainl in cond
bottom adapted to be cosesed by a door or cut-off, and providing bottom adapted to be closed by a door or cut-off, and providing
the interior with steam coils and a diaphragm of woven wire. The said vessels are heated by steam admitted through the steam coils, and also by a steam jacket; and as the scraps of soap are thrown
into the vessel, their lodgment upon the coils and the woven wire diaphragm maintains them in suspension in a uniform steam heat until they are melted; and as soon as melted, they drop through
the coils and waven wire out through the open bottom before the une coils and weven wire out through the open bottom before the soap has time to decompose.

IMPROVED FEATHER RENOVATOR.
Willgam M. Shelton, Williamsburgh, Mo.-This invention is an
improvement upon the feather renovator constituting the subject improvement upon the feather renovator constituting the subject
of letters patent No. 108,161, and relates chiefly to a roll mounted of letters patent No. 108,161, and relates chiefly to a roll mounted
upon a hollow perforated shaft, which is open at one end to adapt it to receive a perforated tube. Steam is admitted to the renovadjusted in a certain position, the steam is prevented passing into said chamber and caused to pass into the hollow casing of the same, for heating it and thus drying the feathers.
apparatus for the manufacture of sulphurous acid. William Maynard, New York city.-This invention relates to certain improvements in apparatus for hydrating gases, and it consists in the particular construction and arrangement of the con-
denser or chamber in which is effected the absorption of the gas denser or chamber in which is effected the absorption of the gas
by the water; the said chamber being provided with an inlet for the water above and an inlet for the gas below, and fitted interiorly with alternating inclined imperforate shelves, which are
provided with ledges or cleats at their lower ends that dam up the water upon the shelves for the absorption of the gas, which water gradually weeps or trickles over the edge of the cleats from one to gradually weeps or trickles over the edge of the cleats from one to
the other of the shelves. These ledges or cleats are also notched and sawn down to form slits or scores, whicn permit the draining of the shelves when the apparatus is not in operation.

## NEW HOUSEHOLD INVENTIONS.

improved washing machine.
James J. Daly, Bloomington, Ill.-This invention consists in placing in a wash box, between tow inclineen parallelenansms, two
wash boards with their ridged surfaces facing each other. The wash boards with their ridged surfaces facing each other. The
projecting ends of the arms are provided with slots in which projections on the upper wash board travel, thus giving the latter a
reciprocating motion short arms, which themselves pivot at their lower end in the inclined parallel arms, their upper arms being connected by a transverse rail. Immediately below the wash boards is a grooved ronler, which has its bearings in the two inclinind arms, and is pro-
vided with ratcheted ends, which are moved by pawls pivoted to vided with ratcheted ends, which are moved by pawls pivoted to
the upper wash board. Motion is imparted to the machine by a the upper wash board. M
crank handle or otherwise.

IMPROVED DRY YEAST COMPODND.
Charles W. Gschwind, Egg Harbor City, N. J.-This consists of boiled hops, scalded wheat tlour, malt, sugar, ginger, rice fiour and middlings. It is well adapted for bread makin.
improved stove covering.
Andrew J. Vandeventer, Martinsburg, Mo., assignor to himself and Archibald M. Vandeventer, same place.-The object of this invention is to improve the construction of the cook room refrig-
erator for which letters patent were granted to P. D. Vandeventer, November 8, 1870, to enable the cooking to be done with less fuel and with a more uniform heat. It consists in doors made in two parts, and with their adjacent edges overlapping eaoh other, and at such a distance apart as to leave spaces between them for the entrance of cold air.

IMPROVED CLOTHES DRYER.
David J. Clark, East Elma, N. Y.-This consists of a series of
horizontal bars, which are connected at their ends by cords, and provided with wires, for the suspension of the clothes beneath the bars. The latter are capable of being folded together or ext
and may be supported upon frames resting on the ground.
improved stove.
Charles R. Sipes, Arkansas City, Kan.-This relates to improvements on a class of stoves known as the "Tod" stove, by which are opened, may be avoided. There is an additional flue and damper at the highest part to prevent the escape of smoke on opening the door, and a swiuging foot rail hinged to the lower
part of the stove.

## NEW AGRIOULTURAL INVENTIONS.

## improved wheel cultivator.

William N. Riddle, Caddo Grove, Texas.-This improved whee ultivator is so constructed that it may be readily adjusted for use in marking the ground, covering the seed, and cultivating the plants. It is simple in eonstruetion and reliable in operation in
either eapacity.

IMPROVED COTTON CHOPPER.
Theodore C. Burnham, Burnet, Tex.-The essential feature of this improved cotton chopper is a contrivance of choppers on vertical rock shafts, with a cam wheel attached to one of the truck wheeis, for closing them, and a spring
row of plants, for chopping them out.

IMPROVED CHUR
Sylvanus B. Robison, Allenville, Mo.-This churn may be readily put into place and detached, and the gear wheels may be readily adjusted to take up the wear.

IMPROVED BUTTER TUB.
James E. Higgins, Holland City, Mich.-This is a device for fastening covers to pails, and other similar packages, by means of a jointed hasp attached to the cover, which shuts over a staple in the
and a wedge plaw ber
COTTON FEEDER AND CLEANER FOR COTTON GINS.
George F. Colquitt, Bremond, Tex.-This invention has reference to devices for feeding seed cotton to cotton gins, and also for cleaning the same preparatory to ginning; it consists of a hopper having wires extending from side to side over a revolving toothed
cylinder and a concave thrasher. It is made to reciprocate on a track by pinions on the ends of the thrasher cylinder, working in double rack bars, one in each side of the hopper, so contrived that the pinions run them over one way and under the other, making simple and cheap mode of obtaining the motion.

TMPROVED GRAIN SEPARATOR.
William Holladay, Blairstown, Iowa.-This invention consists of contrivances for separating the light coarse matters, and also the dust, before the grain goes on to the sieves, and conducting them
away in a tube out of the room containing the mill. By separating away in a tube out of the room containing the mill. By separating
the straw, etc., before coming to the sieves, the capacity of the the straw, etc., before coming to the sieves, the capacity of the
mill is greatly increased, in consequence of the sieves not being choked by such matters. The blast can be wholly turned on either may be applied, by suction, to the grain as it passes off from the screen for separating light grain and like matters, not separat
improved grain elevator for harvesters
Ebenezer McFadden, Sparta, Ill.-This is a contrivance of the teeth, the apron, and the rollers which work the apron, for allowing the teeth to swing back automatically to pass the trough into
which the grain falls, and in like manner take the required posiwhich the grain falls, and in
tion for taking up the grain.
improved sulky plow.
John W. Grimes, Appleton City, Mo.-Tnis invention is an im-
provement in the class of sulky plows in which the plow proper is provement in the class of sulky plows in which the plow proper is to be raised and lowered at will, for the purpose of changing the depth of furrow, or for holding the plow entirely off the ground ment relag transported from one place to another. The improve parts, whereby the plow beam is held steadily while in use, adap ted to be raised and lowered bodily, by means of a single lever, while in operation, and without changing the horizontal position or angle of the plow beam, and whereby the draft is applied
direct line with the plow beam, whatever be its adjustment.

IMPROVED REAPER.
Solomon Rawson, Scott Thacher, and Isaac Rawson, Hornells-
ville, N. Y.-This invention relates to certain improvements in reapers for harvesting grain, and it consists mainly in making the the main frame, in raising and lowering the sickle, by pivoting the tongue to the main frame, just below the bearing or the main drive wheel, whereby the sickle and its driving mechanism are geared directly together without the intervention of a joint, and whereby also the draftis more in a line with the sickle. It also con-
sists in the construction and arrangement of the devices for consists in the construction and arrangement of the devices for con-
necting and disengaging the sickle from its driving mechanism,and in the means ewployed for regulating the motion of the Eertilizer distributer attachment to seed drills
Lyman W. Shepard, Arcola, Va.-The invention relates to an im provement in the class of fertilizer distributers in which the mameans of auger-shaped or spiral twist shafts. The improvem, b consists in the application of radial or curved arms to the feed shafts for the purpose of stirrin
drawing it toward the feeders.
improved horse hay rake.
Amos W. Coats, Alliance,Ohio.-This inventionrelates to certain mprovements in horse hay rakes, and it consists in a cheap, sim ing the rake teeth when elevated, the said clearer being held rig idly in an elevated position above the rake teeth upon supporting bars, projecting rearwaraly from the driver's seat, and forming $\xrightarrow{+}$

## NEW MECHANICAL AND ENGINEERING INVENTIONS.

 improved glove tree.John B. Stevens, Littleton, N. H., assignor to Nelson Parker, of ame place.-This invention is a glove tree, made double or in dujoined together, so that the fingers project in opposite directions The tree is made in sections, and a spring is placed between them
to make the tree expansible and compressible. The invention also to make the tree expansible and compressible. The invention also Includes a sliding clamp for holding gloves while being drawn on the tree. For holding the glove on the table on bench, for insert-
ing the tree, a vertically sliding hook plate is hooked into the treadle for pressing it down, and a spring for raising it

## IMPROVED MOTIVE POWER.

Adam Graner, New Orleans, La.-This invention consists in combining a drive shaft, counter shaft, and saw shaft, the latter pro vided with a roll arranged thereunder. The crank for turning the
driving shaft, by hand, has a handle to which is attached a connecting rod, which, at the lower end, connects with a foot treadle, so that the operator may work with both. It is also proposed to apply these drivers to both ends of the driving shaft in practice. IMPROVED WATER CUT-OFF.
Charles O. Wilson, Cincinnati, 0 .-This consists of a cap in com ination with a crank, so applied to the cut-off pipe as to bring th nication and non-communication with the outlet perfect.
improved barbed fence wire.
George $W$. Allen, Creston, Ill.-This is an improved barb for
ire fences, so constructed and applied to the fence wire that it will keep its solace firmly and securely, and will not slip or turn it consists in a fence barb formed of two short pieces of wire placed parallel with each other upon the opposite sides of, and at
rightangles with, the fence wire, and having their end parts twisrightangles with, the fence wire, and having their end parts twis
ted together, leaving their points projecting.
improved rallroad track lifting machine.
Robert Aldred, Glencoe, Ontario,Canada.-This machine consists or hooks, with whed to run on the rails, and having clamping Jaws suitably arranged for the purpose. The entire apparatus is simple, and apparently effective for the purpose.

IMPROVED DISCHARGING CAR.
James W. McDonald, Campbellton, New Brunswick.-This invention relates to a novel construction of cars, designed for distributing gravel and broken stone upon railroads for the purpose orsts in a car provided with a supplemental frame, carrying poly-
sist gonal rollers at the ends, around which passes a continuous, endless belt of sheet or plate iron, which forms the upper surface o the car. This belt is provided with a detachable connection with the running gear of the car, by means of which it is set in motion at the proper time, and the supported load is evenly distributed at the end, a second endless belt being arranged at the end trans-
versely to the car, and inclined to the earth so as to receive the gravel and stone and carry it from its own gravity to one side of the track whenever it is desired to fill in the road bed upon the side.
improved apparatus for condensing steam.
William Walker, Manchester, England.-This invention is emadmission of water, a fiexible (rubber) button, or diaphragm water supply pipe at the top, a stationary perforated spray plate a water eduction orifice near the bottom, and a steam induction oriffice directly beneath the spray plate. The amount of water admitted to condense the steam, by spraying through the perforated
plate, is controlled by the valve whose rod is attached to the flexible diaphragm, and hence rises or falls as the latter is caused to bulge in or out. The object of the latter is to prevent the vesse being completely filled with water when the pump is running a either high or low speed, as the case may be, so as to ensure a vacuum in the vessel, which may be supplied by the exhaust steam.
improved machine for twisting hay for fuel.
James S. Foster, Yankton, Dakota Ter.-This invention is an improvement upon that for which letters patent, No. 180,218, have been granted. It relates chiefly to the combination of a rotating hook, a sliding extensible frame, carrying the fixed or non-rota-
ting head, and devices for locking said extensible frame and the ting head, and devices for locking said extensible frame and the
rotating head when required in the operation of the machine. The machine forms a double twist of the hay or straw, which is com pact and hard, so that it constitutes a good article of fuel, and i particularly serviceable as such in districts where wood and coa are scarce and dear.
raising and lowering propellers.
Benjamin Mitchell, Hancock, Md.-This invention relates to means for raising and lowering the propellers of canal boats, so as
to cause them to work equally well whether the boat is loaded o not. The invention consists in a propeller shaft supported in sid plates and raised by adjustable hangers; in an auxiliary plate a the outer bearing, that moves with the bearing plate so as alway
to cover the slot in the latter and prevent the ingress of water. I also consists in in the latter and prevent the ingress of water. I close the slot in the fixed plate, in which the inner bearing moves the pinion being adapted to be operated by the same drive wheel, in whatever position it may be placed.
improved machine for bottling aerated waters. George Wenker, St. Joseph, Mo.-This is an improved machine or pump for manufacture of soda and mineral waters, by which the exact quantity of sirup to be used in bottling may be measured for each bottle. It consists of a barrel with adjustable piston
and valve, in connection, with a three-way cock for the sirup and and vaive, in connection, with a three-way cock for the sirup and
aerated water pipes, and a swinging handle lever that opens and shuts the bottle.

MACHINE FOR TWISTING HAY AND STRAW FOR FUEL
James S. Foster, Yankton, Dakota Ter.-In using the machine, a handful of hay or straw is placed in a box and its ends are secured to the heads by clamps. The crank is then turned; and as the hay
and straw is twisted, its contraction draws one head and frame inward. The movable half of the box is folded over upon the sta onary half, doubling the twisted hay, which is afterward allowed to twist itself into a wisp.
improved elevator.
Thomas K. Austin, New York city.-This consists in the arrangeat the front and rear of the building. The said elevators are con nected above and below by ropes or chains, in such a manner tha they may counterbalance each other, and are each provided with gearing, which can be operated by one or more persons on the el-
vator, to raise or lower it, as may be desired.

> IMPROVED GATE LATCH.

Cirby J. Wallis, Troy Station,Tenn.-Thelatch has a curved rear arm, which is extended to a suitable length beyond the pivot to give the required weight for producing automatic locking. When
the latch is applied to doors that are to be opened from both sides, the latch is applied to doors that are to be opened from both sides,
knobs are arranged in connection with a lever that serves to raise knobs are arranged in connection
the latch by turning either knob.
improved weighing scale.
Hosea Willard, Vergennes, Vt . - The object of this invention is of contrive a lever and beam scale in a simple way that will allow of operation. The weight hook pivot is connected adjustably to the beam lever, and provided with a shifting screw to set the scale or net or gross weight. And there are other ingenious device well suited to the ends in view.
machine for shaping grain cradle fingers.
Andrew Denney, Beverly, 0 .-This consists of a disk having a groove in the face, corresponding in form to one half the cross
section of the finger, with a number of radial notches, in each of which is a cutter having a notch of corresponding form. The cuters are bolted to lugs of the disk projecting from its sides. The isk is made to revolve against the blank, which is first dressed on one side and then on the other
improved time lock.
John B. Overmyer and James A. Huston, New Lexington, O.This consists of a time piece having a screw connected with on of the posts of the time mechanism, to be turned thereby. On the the stop from behind the bolt of the lock, the screw being geared to the time piece by friction devices, and having a thumb disk to facilitate the setting of the nut. A graduated scale is arranged in connection with the nut, by which to set it to release the bolt in any predetermined length of time.
IMPROVED CAR COUPLING.

Hiram Pitcher, Fond du Lac, Wis.-This consists of a double coupling hook, that is hinged to the drawbar and united at the front part, to lock over the side extensions of the drawbar to be coupled. The double hooks are raised or lowered by rods extend-

## 

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Pat.Att''ss $\&$ Experts wanted everywhere,to Coll't
Millons. Good pay. Add.Am. Pat.Coll'n Cor.,Phnla.,Pa. Agricultural Implements and Industrial Machin-
ery for Export and Domestic Use. R.H.Allen $\&$ Co.. N. $\mathbf{Y}$. John McDonald (formerly of Kingston, Jamaica)
will piease address Geo. B. Lundy, Balmoral, Ontarlo, Ca. A Responsible Patent Right Manager Wanted-
Carriages and RR. R. Cars can be run without olling. AdCarrages and R.R. Cars can be run wthout olling. Ad-
dress or call on Geo. Beck. Charlotte, Monroe, Co, N. T . Aujustable Screw Wrenches (Monkey Wrenches),
equal to the best in strentin and uthlty. Malled posit
 Pattern Makers can get Metallic Pattern Let-
ters, to letter patterns, of H. W.Knight,seneca Falls, N. Y. Wanted, to take charge of Shop, a a good Machin-
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## 

W. C. W. will find directions for purifying ind a description of an incubator on $p$. 273 , vol 33.-E. F. Y. can waterproof his boots by following the directions on p. 154, vol. 26. Wire will do as well or better than string for the two cent tel-
egraph.-G. P. A. will find a recipe for a durable paint for iron on p. 379, vol. 31.-W. R. H. is informed that a steam derrick is commonly used ight leather shoes by the process described on p. 68 , rol.34.-W. C. M., J. C. L.,J. H. D.,E. L.,R. R.,J. H P. \& Co., S. \& E., and many others, who ask us to recommend books on industrial and scientific sub
jects, should address the booksellers who adver tise in our columns, all of whom are trustworth
(1) F. McA. says: 1. I have produced col
ors from a certain bus, and I have also procured a color from the gum of the fir tree. How can
tell whether they are dyes or not? A. Treat
them with the various solvents, such as water, alcohol, acid liquids, alkaline solutions, etc., until
you discover the proper solvent. Then experiment with the solution obtained on woolen and can I separate nitric acid from a mixture without altering the nature of the mixture? A. You fail to state with what the acid is associated. It is necessary to know this in order to answer your (2) J. W. and others.-We do not think that feathers are generally injured by steam heating. We believe this method is consid-
ered one of the best ways of purifying feathers.
(3) A. S. asks: 1. Is a person liable to ge dog entirely free from having been bitten by
d. No. 2. How soon does it make its appearance? A. Sometimes lays elapse, but it is oftener developed in a fe
days. 3. What are its first symptoms? A. It is characterized, as its name implies, by singular loathing for water, also by violen
(4) J. W. W. says: A friend contends that whisky, brandy, ete., increase in strength afte they are three years old. I contend that they continue to decrease as long as there is any spirit
remaining. Which is correct ? As far as we have observed, the liquors, if kept in barrels, de crease constantly in the percentage of alcohol by vaporation and otherwise.
(5) J. E. F. asks:-What can I mix with cos ton seed oil, as a substitute for boiled oil in
paints, and to make it act as a dryer? A. Lithrge.
(6) A subscriber asks: Is it possible for an the wind? the wind? A. Yes. On smooth ice, sailing at the than the wind. The wedge principle is involved. For example: a wedge two inches square at th head, six inches long, sloped on one side to point f such a wedge be introduced between two su ficiently strong bodies, one of which is fixed, the other movable against the sloping side of the wedge: if sufficient force is applied to the mova le body, it will expel the wedge, which latte the impelling body moves two inches. The ic boat sail is the wedge, ice the fixed body, wind the force acting against the sloping side of the wedge.
Minerals, etc.-Specimens have been reeived from the following correspondents,and xamined, with the results stated:
J. M. N.-It is clay containing a large percentge of carbonate of lime. $-\mathbf{E}$.W.-It is an trilobite ound in the older fossiliferous rocks. It wa long supposed to be an insect fossil, but it was at nearly to the living genera of crustaceans, th erolis, lumulus, branchipus.-D. K. C.-The speci men appears to be brown coal.-H. \& J.-The very clear porcelain.-G. H. S.-Nos. 1 and are magnetic oxide of iron (lodestone). No. 2 is piegeleisen, a carburet of iron with manganese -R.C. J.-Your sample appears to be a scrap of piegeleisen-a carburet of iron.-F. T. M.-Th water contains a considerable quantity of carbon ate of iron in solution, which, on exposure to air,
is precipitated by the escape of the carbonic acid with which the water is charged. The sedimen onsists of hydrated sesquioxide and carbonate of iron, together with some carbonate of lime. The water will be improved by the addition of a ittle lime water-not too much.- R . Y. G.-It an impure clay containing iron. It might beem ployed for the purpose you mention. There is an -we have received a slate pencil box not beled, containing a number of pieces of granite gneiss rock, and hornblende.
J. A. P. asks: In making fruit butter, ete am anxious to know if the dried fruit is wholly used, or is there a mixture of both dried and
fresh? Is it ground, or reduced by boiling, etc.? -A. $\mathbf{R}$ asto: Can any one inform me of the pro cess of making lager beer?-P. McS. O'F. asks: What purpose does the two-fold division of the
back and belly of a violin serve? Is the belly back and belly of a violin serve? Is the belly
carved or scooped out to the proper shape, or is he material steamed and then compressed to the required shape?-J. N. J. asks: How much hould not the under side be straight or level a it lays in the box? Does the concavity of the Wheel make any difference as to the setting of the
axle? Is not a straight wheel better and stronger axle? Is not a straight wh

COMMUNICATIONS RECEIVED. The Editor of the ScIENTIFIC American ac original papers and contributions upon the follow original paper
ing subjects:
On the Moon's Longitude. By J. H.
On Working Men's Education. By A. On Weight on and in the Earth. By H. A. H. Also inquiries and answers from the following : G. F.-L. H.-H. T.-F. T. H.-E. C. W.-W. C.-
C. C.-C. F. \&.-J. E. K.-F. E. H.-M. D. H.-

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ereal, F. Schu Grate, c. B. Mershon
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