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## THE STORAGE OF PETROLEUM.

There is at present, in round numbers, $25,000,000$ barrels of crude petroleum stored in iron tanks in the oil regions of Pennsylvania. It is an inland lake of oil that may be described as having reached its highest ebb, inasmuch as indications $n() w$ point unmistakably to a falling off in the daily production of the wells and a consequent decline in the amount tanked. Not the least striking feature of the oil regions are the clusters of these enormous iron reservoirs, located on hill and in valley, and whose construction keeps actively employed great workshops and an army of men in Pittsburg, Titusville, Pa., Oil City, Pa., and elsewhere. The oil held by the 1,800 tanks dotting the oil regions would fill to a depth of ten feet a square reservoir or lake measuring 3,747 feet each way.
Tank building as an industry dates back to 1861, when the firm of Carroll \& Snyder, of Pittsburg, were called upon to put up what was then considered a large tank, 4,500 barrels capacity. There were grave doubts whether the pressure of the liquid inside would not burst the tank, and the iron plates forming its bottom and sides were made heavier than is now considered necessary in a 35,000 barrel tank. When the tank was finally tested-with water-the spectators kep the water's appearance over the brim. The tank stood lik a rock, and is still in existence and doing service at Natrona, 25 miles from Pittsburg. From that time the success of iron tanks in storing petroleum was assured. In capacity they were yearly increased, until to-day few if any storage tanks hold less than 25,000 barrels, while the majority of those lately contracted for hold 35,000 barrels. These monsters when set up cover as much ground as a circus tent. All are perfectly circular in form, with perpendicular sides and flat top. The largest have a diameter of 94 feet, and are 28 feet high. The iron plates in these vary from three eighths of an inch to three-sixteenths of an inch thick, accord ing to the locality of the plates in the make-up of the tank those nearer the bottom, of course, having to withstand the greatest strain from the confined oil. This pressure, in 35,000 barrel tank (filled), will equal a tensile strain of 7,000 pounds on an inch width of metal surrounding the lowest portion of such tank. The cost, at the present rates of iron, for these storehouses of nature's oil is as follows: For a 35,000 barrel capacity, 28 cents per barrel, or $\$ 9,800$; 30,000 barrel capacity, 27 cents, or $\$ 9,450$; and a 25,000 bar rel capacity, 30 cents, or $\$ 7,500$. The largest sized tank when ready for oil will weigh 93 tons. In their construction very little skilled labor is required, except when "setting up." Improved automatic machinery cuts, bends, and punches the plates with extreme rapidity and accuracy, so that on being set up every one of the 200 plates with thei rivet holes is found in its appointed place. The three lowest "rings" of plates, it might be added, are double riveted. Before the use of plate iron in tank building, wood or wood and iron were used, and to prevent such tanks from leaking was almo
apacit
Of the $25,000,000$ barrels of petroleum now stored in tank fully oue-half is owned by the United Pipe Lines (Standard Oil Company), the balance being owned by other pipe lines and by private parties. A single banking firm of New York owns a half million barrels stored in Pittsburg built tanks and awaiting better prices. The growth of this enormous stock of oil has been as follows, according to the most reliable statistics-the barrels are of 42 gallons each August 31, 1878, 4,599,362 barrels; 1879, 7,620,525; 1880 15,063,651; July 31, 1881, 24,888,337; August 31 (estimated) 25,000,000.

Until very recently only crude petroleum was tanked, but 300 at present a Pittsburg builder is at work on iron tanks for the Standard Company for the storage of refined oil at Louisville, Cleveland, Chicago, Indianapolis, St. Louis, etc. To retain this searching fluid requires an extremely tight and well built tank.

PRESIDENT GARFIELD'S FATAL WOUND.
President Garfield was shot on the morning of July 2, while passing through the Baltimore and Potomac Rall way Station in Washington. The assassin-previously known as a petty swindler and disappointed office seekerfired two shots from a heavy pistol, one ball taking effect.
The wound was expected to be immediately fatal, and during the first day the physicians sought only to diminish the more alarming symptoms by administering stimulants and hypodermic injections of morphia and atropia. In the evening the patient rallied a little and a superficial examina tion was made. The bullet entered the body about two inches to the right of the fourth lumbar vertebra, between the tenth and eleventh ribs. It was mistakenly assumed that it passed through the liver and lodged somewhere in the front wall of the peritoneal cavity. From the supposed nature of the wound the attending physicians thought that death would ensue before midnight. The President did not die, and the expected symptoms of peritonitis and those which should have followed a serious lesion of the liver, kidney, or intestines did not appear.
On the 4th of July, Dr. Agnew, of Philadelphia, and Dr Hamilton, of New York, were called in consultation. No thorough surgical exploration of the wound appears to have
been made, or indeed was possible or justifiable at that time, and the treatment proceeded on the, as it proved, entirely mistaken diagnosis first made.
By the latter part of the month symptoms indicating pus
poisoning were apparent. On the morning of the 24th, Dr. Agnew opened a pus cavity, which had formed a few inches below where the ball entered, and removed a splinter of bone. It was now evident that the ball had struck a ribthe eleventh, breaking it in two places; and it was inferred that it had been deflected downward. Its actual course, however, remained undetermined. Relieved by the better drainage of the wound the President seemed to improve slightly. Another operation was performed by Dr. Agnew, August 8, but its nature and purpose have not been made public. During the ensuing week the decline was steady, if not rapid, and then a more hopeful period set in. This was broken by the appearance of an abscess in the right parotid gland, August 18, followed by trouble in the lungs and a distressing cough. Since the operation of the 8th the patient's stomach had been greatly disturbed and intolerant of food.
The patient's desire to get away from Washington had been persistent, and by the first week in September it was apparent that it was useless to wait for improvement before making the attempt to remove him. Foreseeing speedy death if he remained, it was decided as a last resort to attempt the journey to Elberon, near Long Branch, by the sea. The removal was accomplished September 6, but was unavailing. The sight of the ocean helped to soothe the remaining days of the President's life, but the inevitable end came on the night of Monday, September 19.
The post-mortem examination revealed the not unexpected fact that the wound was in all probability fatal at the outset, and the surprising fact that throughout the physicians had been entirely at fault touching the course and position of the deadly bullet. The official report of the autopsy, dated 11 P.M., September 20, runs as follows:

By previous arrangement a post-mortem examination f the body of President Garfield was made this afternoon in the presence and with the assistance of Drs. Hamilton, Agnew, Bliss, Barnes, Woodward, Reyburn, Andrew H. Smith of Elberon, and Acting Assistant Surgeon D. S. Lamb, of the Army Medical Museum, Washington. The operation was performed by Dr. Lamb. It was found that the ball, after fracturing the right eleventh rib, had passed through the spinal column in front of the spinal canal, fracturing the body of the first lumbar vertebra, driving a number of small fragments of bone into the adjacent soft parts, and lodging below the pancreas, about two inches and a half to the left of the spine, and behind the peritoneum, where it had become completely encysted. The immediate cause of death was secondary hemorrhage from one of the mesenteric arteries adjoining the track of the ball, the blood rupturing the peritoneum, and nearly a pint escaping into the aldominal cavity. This hemorrhage is believed to have been the cause of the severe pain in the lower part of the chest complained of just before death.
'An abscess cavity, six inches by four in diameter, was found in the vicinity of the gall bladder between the liver and the transverse colon, which were strongly adherent. It did not involve the substance of the liver, and no communication was found between it and the wound. A long supplementary channel extended from the external wound between the loin muscles and the right kidney almost to the right groin. This channel, now known to be due to the burrowing of the pus from the wound, was supposed during life to have been the track of the ball.
On examination of the organs of the chest evidences of severe bronchitis were found on both sides, with bronchopneumonia of the lower portions of the right lung. and, though to a much less extent, of the left. The lungs contained no abscesses, and the heart no clots. The liver was enlarged and fatty, but free from abscesses. Nor were any found in any other organ except the left kidney, which contained near its surface a small abscess about one-third of an nch in diameter.
' In reviewing the history of the case in connection with the autopsy, it is quite evident that the different suppurating surfaces, and especially the fractured, spongy tissue of the vertebræ, furnish a sufficient explanation of the septic condi tion which existed.
(Signed)

$$
\begin{aligned}
& \text { D. W. Bliss. } \\
& \text { J. K. Barnes. } \\
& \text { J. J. Woodward. } \\
& \text { Robert Reyburn. }
\end{aligned}
$$

Frank H. Hamilton.
Andrew H. .SMITH.
D. S. Lamb
D. S. Lamb."

## HEAT, SUN STORMS. AND YELLOW LIGHT

The first week in September was characterized by a number of days of extremely hot weather, the temperature in this city rising above $100^{\circ}$ Fah. During the days of great est heat the sun appeared to be greatly disturbed by storms Whether the terrestrial high temperature was due to the direct action of solar disturbances, or to the forest fires then raging in Michigan, or to the indirect effect upon our atmo sphere of the volumes of smoke which darkened the sky ver many thousands of square miles, it is impossible to decide. The phenomena apparently connected with the smoky condition of the air were sufficiently marked to make the week a memorable one. On the 5th and 6th a peculiar yellow haze overspread the land from Canada to the Atlan tic coast, deepening in many places to brown and black, so that lamps had to be lighted at midday. In this city the yellow haze was noticeable, but not so dense as elsewhere At Saratoga the ghastly yellow appearance of the at mosphere increased to the positive shade of an orange lily, and it was increased to the positive shade of an orange lily, and it wa
tance than the width of Broadway ( 125 feet). Between 8 and 9 o'clock A. M. it grew still darker, and many predicted another "dark day" similar to the one chronicled in the early part of the century. The hotels and stores were lighted just as at night, and the peculiarity of the jets was that they resembled the cold, silver color of electric lamps, but of much less power. Another effect produced by the inexplicable state of the atmosphere was the extremely bright green appearance of the lawns and foliage. This was especially noticeable from the fact that the shades of everything else were of a decidedly subdued color. During the early forenoon, outside of the regular routine, business and pleasure were practically suspended. So dark was it at 9 o'clock that when the American Social Science Association met in Putnam Hall every gas jet had to be lighted, and it bore the appearance of an evening entertainment. The extreme humidity of the atmosphere was the subject of general remark, and several who had taken an early drive into the country stated that their clothing was as damp as if they had passed through a shower. The darkness lifted about noon.
At Toronto the darkness continued all day, though as the day advanced the yellow of the sky was brightened to a rich orange hue. In northern New York the atmosphere was of a greenish yellow hue. At Lake Placid, in the Adirondacks, a greenish fog covered the country; the grass seemed artificially colored, the animals had a sea-green color, the mountains disappeared, and in their place were wreaths of green vapor; the clouds were yellowish green; the sun appeared a ball of golden fire through the mist, and all hature seemed to have a strange and mysterious hue. Some people when they rose in the morning feared that their own ejes were jaundiced; others thought that some strange calamity was at hand, some great convulsion of nature; people in many places were in a state of anxiety and dread.
The Boston Journal of the 7th compared the previous day with the famous Black Friday of 1780 . No fog or haze was perceptible, except when looking off toward the horizon from an elevated position, but the sun was thoroughly obscured, and the atmosphere was pervaded with a yellow ish light which lent a strange appearance to every object. There was a weird luster to the surface of the streets and the fronts of the buildings. This aspect of the sky was such that some timorous people's minds were directed by it to the scriptural prophecy concerning the brassy appearance of the sky which is to be one of the features of the "last
day." The interiors of buildings grew dark as the day advanced, and the outer air as viewed through a window seemed to be pervaded with the reflected light from some vast conflagration. It became necessary to light the gas in stores and offices, and the jets admitted a white flame that strongly resembled the electric light. The faces of people in the street were of a deep saffron color, as if jaundice had begun to show its work in complexions tanned by a sum mer of exposure to wind and sun, and some skins even displayed the tint of those yellow beach shoes which have of ate come into fashion. A few buff dresses seemed as yel low as dull gold, and the grass took on a rank and metallic bue like verdigris. The phenomenon became more marked in the afternoon than it was during the forenoon. As late as 1 o'clock it was possible for a person sitting near a window to see to read or write without the aid of artificial light, but after that hour the gloom deepened rapidly, the sky grew still more brazen in appearance, and the gloom was that of late twilight. The front windows of stores on Washington street were illuminated as at night, and there was not a single usual aspect of the daytime to be seen in any direction. There was something terrible in the scene, and it is not to be wondered at if some weak mindsallowed themselves to be tormented by fears of what the extraordinary event might presage. The climax was reached at about 3 o'clock, and after that light began gradually to return, although perfect daylight was not restored. At 5 o'clock, the ruddy glare had disappeared from the sky, and the light, such as it was, seemed more natural than during the day Before 8 o' clock the moon had come out, the clouds had disappeared, and the atmosphere had resumed its normal condition.
As already remarked, this peculiar disturbance of the atmosphere prevailed throughout New York, the Eastern States, and Canada. The forest fires of Michigan and Canada were most commonly thought to be the immediate cause. Professor Emerson, of Dartmouth College, suggested as an additional agent the pollen from northern fir and pine trees. Others suspected that the excessive moisture of the lower atmosphere might have had something to do with the phenomenon. It is possible, however, that some extra-terrestrial cause may have had a controlling influence; something, for instance, like the band of yellow light which spanned the sky on the night of the 12th. As described by the observer above named at Hanover, N. H., the yellow luminous band was from $5^{\circ}$ to $10^{\circ}$ in width, quite uniform throughout, and extended from about $20^{\circ}$ north of west to $30^{\circ}$ south of west, dividing the heavens into northern and southern divisions of about three fifths and two fifths respectively. Its direction was about at right angles with the Milky Way. A very distinctive feature was the regu lar and definitely marked northern boundary. From 8 P.M. to 8:15 P.M. it remained comparatively fixed. At 8:30 o'clock it swept off toward the south, gradually disappearing. Just south and east of the crossing of the streamer with the Milky Way were ten or twelve lines of light, and at right angles with the streamer, but separated $3^{\circ}$
or $4^{\circ}$ from it, and nearly parallel to each other. These bands were $5^{\circ}$ or $6^{\circ}$ in length. During this time there were
faint northern lights streaming up at right angles to the faint
By some it was thought that a nebulous belt had touched the earth's atmosphere. Had such a contact occurred in the daytime, penetrating the atmosphere more deeply, the effect might have been like that of the 6th.
During the auroral display, and for some hours after, the Atlantic cables were greatly obstructed by a magnetic storm, and the land lines also as far west as Chicago. The storm neutralized the force of the batteries, but the atmopheric currents of electricity were not strong enough to telegraph with, as was the case during the memorable elec ric storm of October, 1872.

## THE TEMPERATURE OF MAMMOTH CAVE

## by н. с. нovey

It is estimated that twelve million cubic yards of limestone ave been displaced by the great excavation known as Mammoth Cave. The importance of ascertaining exactly he temperature of the volume of air and bodies of water ound in such a locality appears on considering the fact that it would coincide with the temperature of the earth's crust in the region where it is located.
The task has its difficulties. The darkness of the cavern akes it necessary, of course, to make the observations b lamplight, and the proximity of the flame renders the mer cury liable to expand by an increase of heat. The warmth of the hand may also be imparted to it in carrying the instrument along; and a sensible impression is made even by per ons standing with their lamps at a distance of several feet. Add the fact that all thermometers increase their readings with age, and an explanation is found of the errors into which observers have sometimes fallen, and which I have tried to avoid in the experiments now recorded. The result of such errors is an oft-quoted statement that the uniform temperature of the above cavern and the region around it is $59^{\circ}$ Fah. at all seasons of the year. I shall show this to be too high by about $6^{\circ}$.
My first set of observations were made in August, 1878 with what was regarded as a good thermometer of German make. The table of readings, though not on the whole sat sfactory, may be of some value for comparison, and are given below :

At on the on the hill the mercury stood, at noo on the 19th of August, 1878, at

102 deg. Fah. At the entrance to the cave
In the Rotunda (1,000 yards within)..
In River Hall (a mile and a half within) 10 deg. Fah
58 ". ".
58

At the Bottomless Pit, Mary's Vineyard, Marion's Avenue, and various other points, including the waters of the Dead Sea

In Lucy's Dome.. ............... ............
In the waters of Helen's Spring, Hebe
in the Cascade of the River Styx.
56
55
54
"، ""

According to this table the temperature varies from 52 $58^{\circ}$ in the cave, the average being $56^{\circ}$ Fah.
But this, although $3^{\circ}$ lower than the previous observations f local physicists would justify, proved on comparison with Yale standards to be still too high by two or three degrees and I therefore determined to make a new set of experi ments of such a nature as should insure perfect accuracy. A common, but fairly reliable thermometer was fixed point 1,000 yards within the cave, where it was allowed to remain for six months undisturbed. This gave it time to dapt itself to its surroundings, and gave the manager of the cave, Mr. Francis Klett, an opportunity to take daily obser vations during the transition from winter to summer, and in all sorts of weather. His report to me was summed up in the statement that after being, so to speak, acclimated, this thermometer did not vary more that $1^{\circ}$ for months together and indicated a uniform temperature of from $53^{\circ}$ to $54^{\circ}$ Fah. This was as I had anticipated. But my object being oo ascertain the temperature of a large area it would no do to base a conclusion on the testimony of a single witness, and that an instrument remaining constantly in one place. Accordingly, on revisiting Mammoth Cave, last August, armed myself with two of the best mercurial thermometer belonging to the Winchester Observatory of New Haven, kindly lent to me by Prof. Waldo, the astronomer in charge and which are described as follows:
(No. 1.) Casella, London, K. O. 10,662. The gradation allowed one fifteenth of an inch to a degree, ranging from $-10^{\circ}$ to $+120^{\circ}$ Fah., marked both on the glass tube and on porcelain slide, and determined by comparison with Yale standards to be accurate within two-tenths of a de ree. Mounted in a copper frame with a large ring ttached, by which it could be swung, in order more quickly to bring the temperature down to that of the air, the tube and slide being also detachable from the frame for convenence in immersion in water.
(No. 2.) J. \& J. H. Green, New York, 1879. No. 4,509 space allowed to one degree, one-eighteenth of an inch Graduated from $-30^{\circ}$ to $+120^{\circ}$ Fah., marked on glass tube and metallic scale, and carried by a brass holder. This instrument, having been "seasoned" at the Winchester Observatory, was said to be accurate to within one-tenth of ne degree.
With these practically perfect instruments I took the emperature, first, of White's Cave, about a mile distant
from the mouth of Mammoth Cave, with which it is supposed to have a point of connection. Here the following results were obtained:

| At the mouth of White's Cave, Aug mercury indicated, in the shade | 86 deg. Fah. |
| :---: | :---: |
| Just within the entrance | 80 |
| At the Naiad's Bath (in the water) | 53 " ${ }^{\text {a }}$ |
| ". " " (in the air). | 54 |
| the end of the cave | 54 |

The entire length of White's Cave being but a quarter of a mile, the rapid fall of the mercury from $86^{\circ}$ at the mouth to $54^{\circ}$ at the end confirms the opinion, formed on other grounds, hat it has a secrat connection with the far larger cavern adjacent.
The difference of one degree between the water of the basin and the air above it is not due to. evaporation-care being taken in this and similar cases to avoid this cause of error. It is probable that the temperature of the water is that of the surrounding earth, while that of the air is modified by external influences.
The following observations were made on the 13th and 15th days of August, 1881, in Mammoth Cave:


From this second table of observations it will be seen that the temperature is more uniform throughout the cave than appeared from the notes taken in 1878. The variations occurring are due to actual differences caused by the sinking of cold air to the lowest places. The single exception to this is found at Echo River, which is known to be 328 feet below the surface, and yet has as high a temperature as any other locality in the cave. This may be explained by reason of its connection with the outer pools known as the Upper and Lower Big Springs, and lying beneath the high bluffs of Green River.
The fact that the temperature of the Bottomless Pit at a point midway is higher than at either the top or bottom, may be accounted for by reason of an avenue here setting in that was anciently the path of drainage into River Hall, where the mercury stood at $56^{\circ}$.
It should be stated that the greatest pains was taken to keep the bulb and stem of the instruments dry, except, of course, in observations of the water, which, however, were always taken after those taken in the air, so that results need not be modified by the evaporation of moisture. As a rule, the thermometer was, in each instance, left for half an hour where it could not be influenced by animal heat or that of any lamp, and when the degree was read it was done as quickly as possible, before there was any perceptible rise of the mercury.
By these observations I claim that those made previously and with less accuracy ought to be superseded, and that the following facts are definitely settled, namely:

1. That the highest temperature found in any part of Mammoth Cave, during the bottest season known in Kentucky for many years, does not exceed $56^{\circ}$ Fah., and that may, therefore, be regarded as the maximum
2. The lowest temperature found in any portion of the cave during the six months from March to September, 1881, was that indicated at the Iron Gate, namely $521 /{ }^{\circ} \mathrm{Fah}$., and that may be regarded as the minimum. (It is admitted, however, that the very strong air current at this point may have slightly lowered the mercury by causing the evaporation of unobserved moisture from the surface of the tube.)
3. Reviewing all my observations, made in numerous widely separated localities, I find the mean temperature of Mammoth Cave in midsummer to be $54^{\circ}$ Fah.
4. I regard the temperature indicated on the floor of the Rotunda, and at the bottom of the Mammoth Dome and of the Bottomless Pit, namely, $53^{\circ}$ Fah., as the best indication of the true temperature of the earth's crust in the vicinity of Mammoth Cave; and presumably so for the belt lying along the 37 th parallel of latitude, near which that cave is located.

## More Comets.

E. E. Barnard, of Nashville, Tennessee, discovered at his observatory, at 2 A.M., September 19, a bright telescopic comet in 7 hours 46 minutes right ascension and 13 degrees 28 minutes north declination, with a daily motion of three degrees northeast. Its position is described as near Zeta Virginis. No tail was apparent. The observation was confirmed the next day
Director Swift, of the Warner Observatory, Rochester, N. Y., announces the discovery by him, at 1 A.M., Septem ber 20, of the expected Encke's comet, near Beta Aurigæ. Four comets are now visible with a good telescope-B, C, D, and Encke's.

## MECHANICAL INVENTIONS.

An improved horse power mechanism has been patented by Mr. William McE. Dye, of New York city. The object of this invention is to furnish an improved horse power mechanism for various industrial operations usually performed by steam, water, or wind power. This invention is an improvement in that class of power mechanism which an improvement in that class of power mecbanism which plane, formed practically of a circular disk pivoted at its center on a ball-and-socket or other universal joint, upon which joint the disk is made to oscillate by the weight of a draught animal moving in a regular manner around its perimeter and up the inclined plane.
Mr. Adam Breth, of New Washington, Pa., has patented a new and improved device for cutting or clipping bolts. The invention consists in pivoting the movable jaw of bolt clippers to a bl ock made adjustable by a clamp screw pas ing through slots of spring and jaw
An improved wagon has been patented by Mr. Fredrick Borntrager, of St. Clair, Mich. This invention relates to that class of wagons which have jointed reaches for enabling the wagon to be turned within a small compass.
Messrs. Charles E. Mayo and William L. Perry, of Lowell, Mass., have patented an improved foot power machine for driving saws, lathes, and performing work of similar character requiring small power and high speed. The invention consists in a clutch pulley of novel construction and a treadle arranged to act always in one direction, these parts being combined to secure continuous motion of the driven shaft.
An improved ice cutting machine, patented by Mr. James Shannon, of Cohoes, N. Y., consists of a sled-shaped frame supporting vertical side standards, on which are pivoted forward projecting arms, that are adjustable in a vertical plane by eccentrics and levers, and carry on their free ends vertically-revolving circular saws for cutting the ice, which saws are operated by suitable belts and pulleys on gearing :at form part of the device; and it consists, further, of a $s$ ies of revolving toothed wheels keyed on a horizontal cr iss shaft in the rear portion of the device, which wheels ars designed to rest upon the ice and to urge the machine forward by their revolutions. The saw carrying arms and the rear portion of the machine are also provided with platorms for the operators to stand upon or for the reception of weights to force the saws and toothed wheels into the ice for their more efficient work.

## IMPROVED STEAM ENGINE PISTON.

The engravings illustrate the improvements patented by Henry Waterman, of Brooklyn, N. Y., July 12, 1881, and relate to metallic pistons. The object of the invention is to render the piston tight and prevent loss of power by passage of steam into and through the piston; also to compensate for wear and render the packing and its partseasily adjustable. The invention will commend itself to engineers as being very practical in all its details, easily made, durable, and readily adjustable.
In the accompanying drawings, Fig. 1 is a plan view of the piston, with the face plate and packing disk removed. Fig. 2 is a transverse section of the piston; and Fig. 3 a section of the convex spring packing plate.
A is the hub, formed with the face plate, $a$, and with radial arms, $b$, to which the face plate, $c$, is secured by screws, d. B B are split rings placed upon a wide inner split ring, C. between the plates, ac. The ring, C , is backed at three equidistant points by spring plates, $e$, and keys, $f$, and at the side opposite its open ends by a curved block or plate, $g$, and key or keys, $h$. The arms, $b$, of the hub are recessed at their outer ends to form lugs, $i$, between which the keys, $f h$, enter. The plates, $e$, at each point are two or more in number, so as to form leaf springs, and are secured by a rivet or otherwise to the keys. The block, $g$, is formed with central hemispherical socket $k$ in its inner face and the key, $h$, is formed with a hemispherical stud, $l$, which enters the socket, $k$, the stud thus preventing lateral movement of block, $g$, while permitting it to rock. The outer convex surface of block, $g$, is formed with a transverse groove, $m$, that is engaged by a stud, $n$, projecting from ring, C. By this construction the ring, block, and key are retained in their proper relative positions, and the block may adjust itself accurately to the inner surface of the ring.
In the recesses of the arms, $b$, behind the keys, $f h$, are filling plates or strips, $o$, of any desired number, as required to expand the ring, C. These being placed to fill out the sace when the piston is set or from time to time, as required furnish solid resistance, and unequal wear can be accurately compensated for
It will be seen that the expansible ring, C , is held rigidly at its middle portion between the ends, while the remaining portion is allowed a limited amount of movement by the leaf springs, $e$.
Between the plate, $c$, and the edges of rings, $\mathrm{B} C$, is the packing, $p$. This may consist of a circular plate of spring metal, of convex concave form, as shown in Fig. 3, which being clamped by plate, $c$, packs the joints between the plate and rings, so as to exclude steam from the interior of the piston.
For large size pistons I prefer to use packing rings or ring segments. These will be made of spring metal and curved transversely, so that when placed upon the expansible rings and clamped down by the face plate they insure a tight joint.
This piston, when fitted with plate, $g$, is especially adapted for use in horizontal cylinders, where, on account of the
sag, the wear on the packing rings, B, is unequal. Such
wear can be readily compensated for by adjustment of the wear can be readily compensated for by adjustment of the backing without affecting the solidity of parts.

Fig. 1.


## WATERMAN'S IMPROVED PISTON.

For use in vertical cylinders the plate, $g$, is not essential Further information can be obtained by addressing the patentee, Henry Waterman, 18 Dunham Place, Brooklyn, N. Y.

## CUT-OFF FOR ELECTRIC LAMPS.

The present tendency in voltaic arc systems is to place several lamps in the same circuit, their number varying from


RAPIEFF"S CUT-OFF FOR ELECTRIC LAMPS.
three or four up to forty. The great advantage of such an arrangement exists, as well known, in the great saving in wire that results from it. But, as an offset, it is necessary to employ currents of very high tension, and if this be too great the apparatus may become dangerous; and then, too, the insulation of the wire is very difficult.
In practice it is well not to attain so exaggerated tensions, but to be content with placing only ten, twelve, or sixteen lamps, at the most, in the same circuit. But under these conditions all the lamps are mutually independent, and if one of them, through some accidental cause, is extinguished all the rest go out at the same time. This is a very grave trouble, for which various remedies have been sought. It was for the purpose of obviating it that Mr. Rapieff devised his "safety apparatus," and that all the Brush lamps are furnished with an arrangement called a "cut-off." Mr. Anatole Gérard's "automatic sentinel," which we are about to describe, accomplishes the same object with at least as great a simplicity and with one additional advantage-it is completely independent of the lamp; it forms an apparatus apart, easy to watch, and always within reach of the hand whenever it is desired to make several lamps in the same circuit independent of one another; and it is applicable to all lamps in service, whether they are continuous current or alternating current, voltaic are or incandescent.
The accompanying cut will allow the working of the apparatus to be readily understood. It consists of a straight, tine wire and single-bobbin magnet, the extremities of whose wires are connected with the two upper terminals, to which, also, are joined the two wires coming from the lamp to which the apparatus is adapted. The conductor coming from the machine is connected with the lower terminal to the left, and the wire proceeding from the lower terminal to the right goes to the second lamp and second apparatus.
The two lower terminals are in metallic communication with two small iron cups which are half full of mercury. Above these cups there are two iron rods fixed to a metal cross-piece carrying a hook which engages with a second hook fixed to the armature of the electro-magnet. When the current passes it divides itself between the lamp and the fine wire of the electro-magnet without the armature being attracted thereby. In case of an accident or the extinction of a lamp, the entire current passes through the fine wire, and, the electro-magnet becoming active, attracts its armature, which, on tilting, disengages the hook and allows the two rods to drop into the cups of mercury.
The current then passes directly from one lower terminal to the second, that is to say, from one lamp to the other, through the intermedium of the iron rods; and thus the circuit is not interrupted by the accident which happened to one particular lamp, and all the others continue to operate just as if nothing unusual had occurred
As may be conceived, it would be easy, instead of establishing a direct communication, to intercalate a resistance equivalent to that of the lamp put out of service, so as not to disturb the conditions of the electric circulation; and it would be easy likewise to utilize the fall of the rods for actuating an alarm bell, or even an indicating tablet, and thus to convert theapparatusinto an automatic tell-tale, which would not be without utility in certain kinds of night work.
This apparatus also replaces the ordinary commutator; since, in order to relight a lamp when extinguished it is only necessary to press on the button located beneath. On raising the rod it strikes against a spur projecting from the crosspiece which supports the two rods, and, lifting it, causes the two hooks to engage, and the current then passes through the lamp. To extinguish a lamp it is only necessary to press upon the upper button, when the rod to which it is attached tilts the armature, disengages the hooks, and closes the circuit anew by the dropping of the iron rods into the mercury cups.
In a more recent model than the one here represented Mr. Gérard has arranged the mercury cups one above the other, instead of placing them side by side. The present arrangement gives greater width to the apparatus, which often has to be located on a narrow support, but the principle is in no wise changed thereby.-L'Electricien.

## A Wrong to be Righted.

The schooner M. C. Mosley, of Boston, on the way to Charleston, picked up at sea the captain and crew of the brig Alphonse, which had been disabled in a recent storm and abandoned. At Charleston the health authorities learned that the shipwrecked mariners were from the infected port of Cienfuegos, and properly ordered the Mosley to quarantine. The chance of yellow fever infection from shipwrecked sailors, who had endured twenty-four hours of severe exposure to storm in open boats, was certainly slight; but the law was specific, and the health officers were constrained to obey it.
It does not seem right, however, that the performance of a meritorious act on the part of the captain of the Mosley should meet with no other recompense than the inconvenience and losses incident to quarantine. That would be very like imposing a penalty for doing an act of humanity. The case would seem to be a suitable one for special action on the part of the national government, to recognize and reward appropriately the conduct of the captain and crew of the Mosley, and to repay the owner of the vessel for the loss occasioned by the delay in quarantine. The case is not likely to be often repeated; still, it would be a misfortune to have an evil precedent established by means of it.

## Fire Engineers, Convention

The ninth annual convention of the National Association of Fire Engineers assembled in Richmond, Va., September 13, President Green, of Boston, in the chair. The officers elected for the ensuing year were: President-G. Watt Taylor, of Richmond. Vice-Presidents-One from each State. Secretary-Harry Hill, of Cincinnati. Treasurer -A. C. S. Hendrick, of New Haven, Conn

## LIME-EXTRACTING HEATER AND FILTER.

Where the feed water is pumped directly into the boiler without being purified, the heat soon frees the impurities, which are precipitated upon the inner surfaces of the boiler shell and upon the flues, to which they cling in the form of scale, which is a nou-conductor of heat, and being interposed between the water and the boiler shell, allowing the fire to act injuriously on the iron, rapidly deteriorating it, soon weakening the boiler, and incurring the dangers of explosion and the expense of frequent repairs. Stoppages and delays in cleaning boilers, as well as priming or foaming, which carries grit over into the engine to its great injury, must be reckoned among evils resulting from impure feed water
The actual cost and damages sustained from these more prominent evils, together with many minor ones unmentioned, all of which directly and inevitably result from the presence of scale in boilers, if summed up and expressed in dollars would greatly astonish steam users.
Much thought, time, and money have been expended in experimenting with reference to the nature and effects of boiler incrustations. In an able paper on "Incrustation of Steam Boilers," read before the American Association for the Advancement of Science by Dr. Joseph G. Rogers, he says: "The evil effects of scale are due to the fact that it is relatively a non-conductor of heat. Its conducting power as compared to that of iron is as 1 to $\frac{37}{56}$. This known, it is readily appreciated that more fuel is required to heat water through scale and iron than through iron alone. It has been demonstrated that a scale of one-sixteenth of an inch thick requires the extra expenditure of fifteen per cent more fuel. As the scale thickens the ratio increases; thus, when it is one-fourth of an inch thick, sixty per cent more is required; at one-half of an inch, one hundred and fifty per cent, and so on. To raise steam to a working pressure of ninety pounds the water must be heated to $320^{\circ} \mathrm{Fah}$. This may be done through a one-fourth inch iron shell by heating the external surface to about $325^{\circ}$. If a oue-balf inch scale intervenes the boiler must be heated to $700^{\circ}$, almost a low red heat. The higher the temperature at which iron is kept the more rapidly it oxidizes, and at any temperature above $600^{\circ}$ it soon becomes granular and brittle from carbonization or conversion into the state of cast iron. Weakness of boilers thus produced predisposes to sudden explosions, and makes expensive repairs necessary."
Ordinarily there will have accumulated in a new boiler after four months' use one-sixteenth of an inch of scale; afte eight months' use, one eighth of an inch of scale, and so on. Now, if Dr. Rogers' theory is correct, it necessarily follows that after one month's service a boiler will consume three and one-fourth per cent more fuel than at first; after two months' service, seven and one-half per cent more, and so on, making an average for the year of over twenty per cent more fuel than it would have consumed if using pure water
The difficulty of this scale formation can be overcome in three different ways:
First.-Picking the scale off by mechanical means.
Second.-Purging the boiler by means of the chemical compounds known as boiler powders. This is dangerous, chiefly from the fact that an acid or other chemical strong nough to eat off the scale will not stop there, but will go ahead and eat the boiler shell as well.
Third.-The use of pure water. The simplest and surest way is always the safest and best. If the water is purified from scale forming material before entering the boiler, cer tainly no scale can form
This brings us directly to a consideration of the mean acknowledged by competent engineers as the best in use for the prevention of this formation by the furnishing of pure water, and this is exactly what the Stilwell heater accomplishes. The water euters the heater at the top, and in its downward passage traverses a large area of heating and depositing surfaces, arranged in the form of removable shelves, having alternate openings. As the thin sheet of water passes over these shelves, all of which are very hot, and descends from shelf to shelf, it is met in its downward course and constantly acted upon by an ascending current of steam which enters the heater at the lower port. The action of this lower current of steam completes the separation and precipitation of the foreign particles which is begun when the water enters the heater. The construction of the heater is such that not a drop of water can pass down through it without being thoroughly boiled. The lime, magnesia, sulphur, iron, silica, etc., which this process of boiling sets free from the water, are deposited in a crystallized state upon the entire series of shelves, the deposit always being heaviest upon the upper shelf and diminishing in quantity as it approaches the lower shelf. From this lower shelf the water passes through the filtering chamber, which completes the purification, and it is then fit to enter the boiler.
In this heater the escape steam from the engine is utilized, and the volume used enables the purif ying of large quantities of water, while every particle of the water is boiled thoroughly.

The arrangement of the shelves and the ease with which tey can be handled and withdrawn for cleansing.
The filtering system, the leading point in which is that the water passes upward through the filtering chamber on its way to the discbarge pipe and not downward or sideways, as is usually the case.


STILWELL'S LIME-EXTRACTING HEATER AND FILTER These heaters have been tested abundantly during the pas ten years, and we are informed that there are to-day over thre thousand in active use. They are manufactured by the Stilwell \& Bierce Manufacturing Company, of Dayton, Ohio.

## IMPROVED COMBINATION TOOL

The engraving shows a new implement combining many useful tools in a compact and handy form. It forms a pair

of nippers, A, a pair of pliers, B, which are provided with for the purpose of crimping the ends of stove pipe facilitate putting the lengths together.

The end opposite the pliers is formed into a hammer head, C, against the under side of which the jaw, D, closes. This jaw and the adjacent surface of the hammer head are recessed, forming a holder for the nail, enabling the user to start and drive a nail with one hand.
The two halves of the tool are perforated at $F$, at the joint, to form a wire cutter, and an adjustable jaw, G, is fitted to the handles, forming a monkey-wrench.
A screw, J, in one of the handles, and a corresponding hole in the opposite handle, forms a punch and die for making holes in metal.
The end of one of the handles forms a tack puller, and the end of the other a screwdriver.
Fig. 1 shows the head of the implement and the end of the handles.
Fig. 2 shows the implement with the wrench jaw attached.
This invention was lately patented by Mr. John Straszer, of Manchester, Mo

Eruption of Mount Lapwai, Idaho.
The recent report of a volcanic eruption in Idaho Territory is confirmed by a correspondent of the Eagle, of Butler, Pa., who visited the volcano about the middle of August in company with a representative of a Walla Walla newspaper.
As seen from Camas Prairie the column of smoke rising from Mount Lapwai was like that of a steamer beyond the horizon at sea. The mountain is two days' ride from Camas Prairie. Omitting unimportant personal details, the correspondent's account runs as follows:
" About 500 feet below the cone a large column of smoke sprang into the air hundreds of feet and then folded over to the east. Flames shot up to a great height, and a scething flow of lava was at that time rushing down into a small valley to the west and emitting a strong, sickening sulphuric odor, which made it impossible to remain by it any length of time. The lava had moved a distance of one mile from the mountain and was gradually making its way toward the Salmon. The neighboring hills were covered with ashes."
The visitors were informed by a Lapwai Indian that the lava flow is intermittent. With the wind at their backs they climbed the cone when the crater was quiet, though greatly disturbed and sickened by the sulphurous odors. The crater was about 500 feet below the rim of the cone, and appeared to be about an acre in extent. When the flow ceased the visitors went down to the edge of the crater, after covering their faces with rubber folds and their eyes with glasses. The heat was great. On one side it was possible to descend twenty feet into the crater without being nauseated, thanks to a favorable wind. The lava poured into the crater from the sides, and, when it was full, bubbled over and ran into the valley. The surrounding country is volcanic, and the Indians reported a recent eruption of Mount Idaho, a large peak a few miles from Mount Lapwai.
The visitors spent twenty minutes in the crater. At 5:45 P.M. the flow began again, and they hastily retreated. Scientific parties were fitting out at Portiand, Oregon, toward the end of August, to visit the volcano. Mount Lapwai is one of the Blue Mountains, a low rangecrossed by the Snake River.

## New Steamer for Oregon.

The new iron steamship, Walla Walla, the seventh vessel built by John Roach \& Sons for the Oregon Navigation and Improvement Company, is now taking in cars and railroad material for the company, preparatory to her voyage to Oregon. The Walla Walla is 336 feet in length, $401 / 2$ feet beam, $231 / 2$ feet depth of hold, and of 5,000 tons displacement when loaded. She is constructed wholly of iron, with seven watertight compartments, with one complete iron deck, and the second deck is three-fourths iron. As she is constructed for the purpose of carrying coal between Seattle, Puget Sound, and San Francisco, and will probably return without cargo, she is fitted with three water-ballast tanks to retain the center of gravity on line with the keel, when the vessel is discharged of cargo. All the deck houses are built of iron, and a handsomely furnished cabin and staterooms aft afford accommodations for thirty first-class passengers. The vessel is fitted with compound engines of 2,000 estimated horse power, and has six cylindrical boilers, and her estimated speed when fully laden is twelve knots an hour. She is schooner rigged, with a square sail forward, and upon her arrival at San Francisco will take her place on the regular route with the two other colliers recently built-the Willamette and the Umatilla.

## Battery Carbon.

A useful method of preparing cheap carbon poles for vol taic batteries has been devised by M. Mauri. It consists in taking finely powdered graphite mixed with an equal weight of sulphur free from carbonate, and heating the mixture in a crucible until all the sulphur is fused. The temperature, however, should not be raised over $200^{\circ}$ Cent. When the mass is fluid it is poured into a suitable mould of metal, and a stout copper wire is inserted to serve for an electrode. When the mass is cool and solid it is ready for use. Its conWuctivity is practically as good as that of the best retort carductivity is practically as good as that of the best retort car-
bon, and as it is more electro-negative than simple carbon, the electromotive force of the cell is higher. By increasing the proportion of sulphur in the mixture a highly resisting composition may be obtained which can take the place of copper or platinum silver coils for telegraphic or electric lighting purposes.

## AMERICAN INDUSTRIES.-No. 76.

gachinery in the boot and shoe manufacture, at the FAIR OF THE
TUTE, boston.
Never before has there been so good an opportunity for the public to become familiar with the modern processes of boot and shoe making as is presented in the "Model Shoe Factory" of Messrs. Houghton, Coolidge \& Co., now running in the Fair of the New England Manufacturers and Mechanics' Institute at Boston. About 160 hands are employed, making an average of 600 pairs of boots a day, and doing the work thereon in the same way as the business is followed in half a hundred towns in Massachusetts, with all the modern appliances for facilitating production and making the best finished goods in complete and regular opera tion. There have been other exhibitions in which portions of the work have been shown, and much of the machinery now employed in the boot and shoe manufacture has been in use many years, but here a visitor can see every detaii of the work, from the leather as it arrives from the tanneries and currying shops until the finished goods are boxed up in the
cases which are to convey them from the exhibition building to distant parts of our own country, or even to foreign ports. We have, it is true, but a small export trade in boots and shoes, but this exhibition has been an object of great interest to many foreign visitors interested in the trade, as well as to our own manufacturers, and some orders for goods for export direct have been placed by foreigners who been there looking into our processes of manufacture.
The illustrations on our first page give a good representa ion of this "Model Shoe Factory" and the building in which the exhibition is held, as well as of some of the most
important machinery used. The building is a solid strucimportant machinery used. The building is a solid strucby 551 feet, the shoe factory taking up an area of about 50 by 450 feet, and in this section are to be found nearly 100 machines, large and small, operated by over 300 feet of shafting. But it is curious to note that, with the vivid portrayal of the methods of modern manufacture here brought before the eye, the crowds constantly passing and repassing seem nowhere to find so great an altraction as in watching the work of the venerable looking shoemaker, who, occupying an old shoemaker's bench on which he has followed his trade for fifty-six years, continues here to represent, in the midst of such surroundings, the difference between " the old and the new."
The cutting of the sole stock, as in most modern factories, is here done with dies, and the fitting up of a large factory with the different sizes and shapes of dies required forms no inconsiderable item of expense, leading the manufacturer to strenuously oppose any change of fashion which will necessitate the making of a differently shaped sole. In many cases the sole leather is first cut into strips, the width of which equals the length of a sole, but the later and more approved plan is to cut directly from the whole side, as here shown. The whole side is laid out upon a large table, the top of which is level with the bed of a machine long enough to take in its entire length, so that the workman can place the die on any portion of the side, and then, by a treadle movement, instantaneously bring down a bar with sufficient force to cut out the sole. This may be done as rapidly as the operator can place the die, but good judgment is required in selecting the most thick and solid parts of the leather for outsoles, the thinner and poorer portions being used for insoles and heels. Smaller machines of the same style are used for cutting out the taps, counters, and heel lifts, as these are cut from the parts of the side left after all the outsoles possible have been cut therefrom, the dea in each instance being to so place the dies on the stock as to avoid waste.
The cutting of the uppers is all done by hand, the sides of upper and calfskins being laid out where the cutter can have good opportunity to examine the leather in every part before placing his patterns thereon, in order not only to cut up the stock with the least waste, but to be sure and have good strong leather on the vamp and forepart of the boot, the poorer portions being used for the backs.
In order, however, to give the leather such shape that it may be brought to fit the last snugly, and not partially straighten out or lose its form at any time afterward, the uppers must be broken or crimped. To do this work well was always a laborious and tedious operation, until, about ten years ago, the S. W. Jamison crimping machine
was introduced. A view of these machines is shown at the was introduced. A view of these machines is shown at the heaviest cow-hide leather can be forced into the desired shape for lasting almost instantaneously, the stretch of the leather required in this forming being so evenly distributed that the strength of the stock is not impaired and the leather will hold permanently its new form. The machine is a powerful but not very complicated one, a former, worked by a lever, forcing the upper into suitably shaped jaws, which close upon and smooth it into the desired shape. These machines have so fully met the requirements of the trade that they have become deservedly popular and been widely introduced, as it had hardly been possible, before this machine was brought out, to thoroughly crimp the leather used in heavy boots and brogans so that they would steadily retain their shape after repeated wettings.
For the putting together of the uppers of boots and shoes two distinct styles of machines are used, one using waxed thread for heavy leathers, and for stock in general which bas oil or stuffing in it, and the other using dry thread for goat
and kid and sheepskin work, for fancy stitching generally, the plunger; thus closing every joint in the heel, which, and for putting in linings, working button holes, etc. The upon this machine, may be made of any shape whatever. goods made in the "Model Shoe Factory" being a standard This machine is the simpler and less expensive, as well grade of heavy work, wax thread machines only are used as applicable to a wider range of styles.

After the bottoms and the heels have been atiached and trimmed, there is quite a variety of machines for trimming and shaping the edges, for buffing the bottom, and for burnishing the edges of the sole, shank, and heel, in all of which operations the work is greatly expedited and generally better done than it would be possible ordinarily to do it by hand. But one of the last operations is the treeing, which has much to do with the making of a nice looking boot, for the leather, which has been repeatedly wet and constantly handled through so many operations, must be again made to look its best, with all the seams smoothed down, and the shape of the boot effectively brought out.
For this purpose a machine is here used which is quite new in the trade, a representation of which is given in one of the separate views on the first page, while it can also be readily seen in the foreground of the large view at the bottom. By this machine hot air is used to warm the leather thoroughly through, and so soften the oil and tallow with which it has been curried. The operator, after putting the wet boot on an arm of the machine, passes it on and adjusts another, until, when twelve boots are thus placed, the first one has come round to him again, sufficiently warmed and dried to be ready for the final rubbing, after which it goes to the packer. The amount of heat usually applied is only about one hundred degrees, though this can be regulated at pleasure, and the better feeling and fine finish which this process gives to the leather are casily perceptible. The hand rubbing is also materially lessened, as is the work of taking out and putting in the feet, and far less space is required for drying than is called for under the old system.
Our illustration gives a view of the machines as they have thus far been constructed, but patterns are now being made for a new style of table, in which the trees are so arranged by a slotted joint that they may all hang down instead of being rigidly extended in their circuit as at present. A company has been formed for the introduction of these machines under the title of the Hot Air Boot Tree Manufacturing Company.
In all the work of a modern shoe factory, two points stand out in marked prominence. One is the extreme care which is taken in the cutting of stock, not only to see that there is nowhere any waste, but to have every piece of leather, so far as the best experience can effect the object, worked up into just the part of a boot or shoe for which it was intended when the leather was bought. The other, and equally important point is the minute division of labor. It has often been said of late years that there are no shoe makers now as we used to know them in former times, and this is to a great extent true, for but comparatively few of the workers in shoe facturies now know more than one or two specia, details of the work. But this limiting of their labor has made them especially skillful therein, and machines have been devised for nearly every separate operation. In the boot and shoe manufacture Massachusetts has always been almost immeasurably ahead of every other section of the country, and Boston is by far the largest market for boots and shoes in the world. There were shipped from there durand shoes in the world. There were shipped from of cores and ing 1880 over two and a quarter million cases of boots and
shoes and rubbers, to interior and coastwise ports, the cases halding from twelve to seventy-five pairs per case, but contalding from twelve to seventy-five pairs per case, but a low estimate, over fifty million pairs. But with taining, at a low estimate, over fifty million pairs. But with
this vast trade the competifion is especially keen, a dollar profit on the cost of twelve pairs of staple boots being considered a fair working basis on the business as it is being done this year, with much of the business being done at even less than this figure. It is, therefore, particularly appropriate, that in one of the two great fairs now being held in Boston, we should have so thorough a representatiou of an industry so distinctively pertaining to that section, and one in which the people everywhere are so directly inten, and
The firm of Houghton, Coolidge \& Co., who make the exhibit, run several factories, in different towns, for the production of a variety of leading styles of goods, which are sold in all parts of the United States, their aggregate manufacture not being exceeded by that of any other house in the country, and being materially greater than that of any foreign house. Mr. A. L. Coolidge, being one of the executive committee having in charge the getting up of the fair, proposed and undertonk the setting up of the "Model fhoe Shop," when but little time was left to make the arrangements, but in selecting as its superintendent Mr. arrangements, but in selecting as its superintendent Mr.
C. H. Tilton, who was a manufacturer for him in Ashland, C. H. Tilton, who was a manufacturer for him in Ashland,
Mass., he obtained a practical manager of rare executive Mäss., he obtained a practical manager of rare executive
ability, and the work has gone on smoothly from the day of ability, and the work has gone on smoothly from the day of
the opening in such a way as to form the principal attraction of the exbibition, and be in every way a credit to the originator of the plan and the great industry it so well represents.

## Portrait of Columbus.

In the Spanish Colonial Office of Madrid there has lately been discovered a portrait of Columbus, made when the been discovered a portrait of Columbus, made when the
great explorer was about 40 years of age. It represents him without any wrinkles on his broad forehead, with dark, thick hair, a brilliant eye, and a beaked nose. The portrait is in perrect state of preservation and the inscription is intact. It reads: "Columbus Lygur., novi orbis repertor." The size of the portrait is about 16 by 20 inches.

## potatoes and their utilization.

One of the leading qualities of the potato is its extraordinary productiveness, far exceeding that of any esculent with which it can be placed in competition, one authority placing the yield from an equal quantity of ground at thirty pounds of potatoes to one pound of wheat.
In 1870 there were nearly one hundred and forty-four million bushels of potatoes produced in the United States, and certainly much more than that quantity will be gathered this year. In spite of the great market for this staple of food. it very frequently happens, especially in some of the extensive farming districts in cur Northwestern States, where transportation rates are high, that overproduction so affects their value as to make the tubers unprofitable to handle, and, as a consequence, thousands of bushels of them are annually lost or thrown away.
In this connection we have been so frequently asked for what purposes other than as a food the potato can be utilized, that we will endeavor to answer the question.
Potatoes are composed very largely of starch and water, their average composition in northern latitudes being: Water, 75 per cent; starch, 21 per cent; albumen, cellulose, fat, and salts, 4 per cent. The water can be expelled by exposure to heat at a temperature of about $212^{\circ}$ Fab., the residue having the composition: Starch, 83.8 per cent; albumen, cellulose, fat, and salts, $16 \cdot 2$ per cent.
Nearly the whole of the starch can be separated from potatoes by simple and inexpensive mechanical operations, and as starch is a commodity for which there is always a good market, and as it can be stored for an indefinite time without danger of deterioration, it is obvious that potatoes may be profitably utilized in the production of starch.
The plant required to make marketable starch is quite simple and easily constructed by any intelligent farmer-a wire basket to wash the tubers, a rotary rasping machine, a few large tubs or watertight hogsheads, some wire and hair-cloth sieves, and a drying room, comprising the principal pieces.
A simple rasping machine is shown in Fig. 1, and cousists of a band wheel, A, over the rim of which has been secured, rough side out, a piece of sheet iron previously roughed up like a nutmeg grater by punching it full of holes with a blunt-pointed tool. The wheel is mounted on an axle suyported by the wooden frame so as to revolve immediately beneath the mouth of a metal-lined wooden hopper, B.
A more effective rasper or grinder is shown in-Fig. 2. It consists of a cylinder, $c$, twenty inches diameter and two feet long, mounted on an axis. It is armed with steel saw plates placed about three quarters of an inch apart, parallel with the cylinder, and having small and regular teeth. The plates are held in position by iron clamps, so that the toothed edges project about four-fifths of an inch from the periphery of the drum. It is driven at the rate of about eight hundred revolutions per minute before the hopper, and is capable of pulping about forty-eight bushels of potatoes an hour. In both these machines the rasping surfaces are kept clean by the action of small jets of water projected with some force.
As the washed potatoes are passed through one of these machines the pulp and wash water is run off into tubs, and after the coarser particles have been deposited, the milky liquid is drawn off into other tubs and the starchy matter allowed to settle. Or, as in large factories, the pulp may be rubbed and washed through a series of sieves, ranging from coarse wire gauze to fine hair cloth. After repeated washings with fresh water in the tubs to separate the gummy and fibrous matters, the starch granules are finally allowed to settle, and after the water has been drawn off the pasty mass of starch and water is run off into long wooden troughs, sligbtly inclined, wherein the paste gradually hardens as the water drains off. When hard enough it is cut into blocks and put on shelves in a warm room to dry out. With good management from seventeen to eighteen pounds of clear starch can be obtained by these simple means from one hundred pounds of average potatoes, which could be disposed of in bulk at present prices.
Starch is not only used for "starching" and sizing fabrics and for various food preparations, but also for the manufacture of grape sugar, glucose sirup, gum dextrine or British gum, and alcoholic liquors. When gradually heated in the dry state to about $160^{\circ} \mathrm{Fah}$., in a rotating cylinder similar to coffee roaster, and kept at that temperature for a short time, the starch is transformed into a gummy substance called dextrine or British gum, soluble in cold water, and extensively used as a substitute for gum arabic
When boiled for a few hours with water containing a small quantity of sulphuric acid it is gradually transformed into grape sugar or glucose-a kind of sugar extensively used by confectioners, brewers, distillers, and wine makers. The acid used is removed from the sweet solution by adding to it the proper quantity of chalk or lime with which the acid forms an insoluble substance easily separated.
Whisky can be made directly from potatoes. The potatoes, after being finely mashed with boiling water are mixed with about five per cent of malt, the diastase of which on standing converts the starch into grape sugar, one and one
half or two per cent of yeast is then added, and the fermentation allowed to proceed at a temperature of about $80^{\circ} \mathrm{Fah}$., until the sugar has been converted into alcohol and carbonic acid. The alcoholic liquid when submitted to distillation yields whisky-one bushel of good potatoes yields about seventeen pounds of the liquor. The fermented
potato mash can also be converted into a vinegar by allowing the fermentation to continue after the sugar has all been changed to alcohol, or more rapidly by passing the alcoholic liquid through an Essigbilder or quick vinegar apparatus. A cheap apparatus of this kind may be made from a large barrel, as shown in Fig. 3. The barrel is provided with a perforated false bottom at $a$ and a tight shelf at $b$. Birch shavings soaked in good vinegar are loosely packed into the space between the shelf and false bottom. The shelf is perforated with a number of

small holes, through each of which is drawn a few strands of packing thread knotted at the top so as to loosely close the hole, $d d d$; in the figure are short pieces of glass tubing secured in larger holes in this shelf. Around the sides of the barrel, just above the line of the false bottom, are pierced a number of air holes. When a warm alcoholic liquid is poured over the upper shelf of this apparatus it gradually trickles down through the pack thread and over the shavugs, where it is bjought into intimate contact with au upward current of air from the air holes below to the glass tube exit above, and is gradually changed into vinegar which

collects in the portion bencath the false bottom and flows off through the curved siphon tube, $g$. If the barrel is small it s usually necessary to pass the liquid through the apparaus three or four times before acetification is complete.
Recently a company has been formed in California for pre paring (among other things) desiccated or dried potato The drying is accomplished by passing a current of dry air at a temperature of about $140^{\circ}$ Fah., over the potatoes, cut in very thin slices, in kilns or ovens provided with a system of movable shelves. Doubtless a large demand for such an article would not be difficult to develop.


Boiled (dry) potato mixed with zinc chloride and barytes has been us

AGRICULTURAL INVENTIONS.
An improved arm seeder has been patented by Mr. Philip Strong, Jr., of Saranac, Mich. .This device is to be carried or worn by the person using it, by means of which all kinds of grain or seed may be scattered or sown broadcast over the
ground evenly and with less exertion than heretof ground evenly and with less exertion than heretofore; and the invention consists, principally, of a bag having a flexible ube or smaller portion connected to a sectional metal dis tributer, which is provided with a valve, and adapted to be wong from side to side for throwing and scattering the grain, the supply of grain from the bag being regulated by means of the valve

An improved cotton chopper has been patented by Mr. Jay J. Johnson, of Aberdeen, Miss. The object of this invention is to facilitate the chopping of cotton and other drilled plante to a stand.
An improved fence has been patented by Mr. Jesse M. Womack, of Log Town, La. The object of this invention is to economize space and material and produce a substantial and durable fence.
An improved cotton chopper has been patented by Mr. Friederich A. Helmecke, of Round Top, Texas. This invention consists in a novel construction and arrangement of devices for raising and lowering the hoes and throwing them in and out of gear.
An improved harrow, patented by Mr. Benjamin Jones, of Orange, Ill., has a series of long stationary beams, a series of short stationary beams interposed between the rear parts of the long beams, the connecting cross bars, and moved by crank rods pivoted to the stationary beams.

## The Great Fires in Michigan.

While the loss of life during the terrible fires in Michigan, during the first week in September, proves to be less than was at first estimated, the resulting distress is far greater than any one supposed possible. The state of the afflicted communities is accurately described in the proclamation of Governor Jerome, dated Detroit, Mich., September 15. He says:

- Portions of four counties of this State, lying principally between Saginaw Bay and Lake Huron, have been devasated by forest fires. A drought, almost unprecedented in his section of the country, had prepared the way for the calamity, and houses, barns, fences, crops, cattle, agricultural implements, household furniture, clothing, and human ife have been destroyed by its ravages. In some townships the destruction is complete, and only a picture of ruin left. It is known that more than 200 lives have been lost by burning and suffocation. Many individuals have become helpless through injuries and exposure, and some are blind. The number of men, women, and children left without shelter is estimated at 15,000 . The benevolence of the citizens of the State responded promptly to the first necessities of these afflicted people, but ample time has now elapsed, and sufficient details have been received to make it evident that a wider appeal is needed. The destitution prevailing in the suffering counties is appalling. Entire neighborhoods are involved in a common calamity, and cannot help each other. Sufferers have no provisions, except such as are brought from a distance, and no utensils to cook with. Necessaries of life, both large and small, have been destroyed. They need shelter, clothing, shoes, cooking stoves, kitchen utensils, beds and bedding, wagons, harness, plows, hoes, tools of all kinds, seed for future crops, and whatever helps to make men self-supporting."
Four days later, after traversing a large portion of the burned district, Governor Jerome announced that his estimate of the loss of life and the number of sufferers was not exaggerated.
The burnt district covers a territory of about 1,800 square miles, about one half of which escaped the flames; the other half is a blackened waste, the destruction of property being pretty evenly distributed over the whole territory. It was an agricultural country, with occasionally a village or s mall business center, where were flouring mills, sawmills, stores. churches, etc. Many of these places and their industries were wholly destroyed, and in the farming portions, in the track of the fire, nothing is left for man's use but the land. Barns, cattle sheds, and structures of every kind that remain are being utilized as temporary shelter for the homeless. Hospitals for the care of those who suffer from burns are already established.
Any one who has had experience of forest fires on a considerable scale will be able to frame a faint conception of the terrible whirlwind of flame that burst upon the Michigan settlers that fatal morning. Words are inadequate to convey any idea of it.

The Governor says further:
"The aid extended to the unfortunate by those whose homes were saved will soon exhaust the surplus of the latter. What these people require is aid to procure such necessities as will enable them to live upon and till their lands. They must have food until the harvests of 1882 are gathered. Anything short of this will fail to accomplish the undertaking.
"The first effect of this disaster was to stupefy or paralyze the energies of these people. The prompt aid and encouragement received have stimulated them to new efforts to help themselves. With the bare land and their labor only left they begin to build anew. Already many are constructing $\log$ houses, and every available team is being worked with vigor to put in wheat, the seed for which is furnished by the relief committees. They appreciate their condition and the necessities for labor, and will struggle hard to do their part as they have the opportunity."
The attention of the public has been diverted somewhat from the Michigan sufferers by the rational affliction through the death of the President. It has been suggested that the materials used in draping dwellings and business places be contributed to the victims of the fire. Very much of the material may be made useful for clothing, bedding, and other houschold purposes; and liberal gifts of clothing and money would be likely to accompany such contributions. Winter is fast approaching, and what is done should be done speedily.

THE FONTAINE LOCOMOTIVE.
We present an engraving of the Fontaine locomotive. which is just now attracting considerable attention in engineering circles. This machine has been in practical use for some time on the Canada Southern Railway, and is credited


with being capable of attaining a speed of ninety miles an obsquely and in a diagonal line to the axis of the driving hour. The second engine of this class was lately turned axle. The driving wheels are of the usual construction, out of the Grant Locomotive Works, at Paterson, N. J., and $\quad$ but do not touch the rails. Resting on the rails are other | is to be tested for two weeks on the New York, Lake Erie, | driving wheels of the same size as the upper ones, with |
| :--- | :--- |
| and Western Kailroad before it is shipped to its destination. |  |

- ance, when motion is communicated to the upper wheels, the same motion is transmitted to the lower ones by friction. The lower wheels are constructed with two treads, the periphery resting upon the rails, and the other supporting the upper wheels.
To prevent slipping, an air pump is employed, which is operated from the cab, and which acts on a system of levers, by means of which the frictional contact between levers, by means of which the frictional contact between
the upper and lower drivers is diminished or increased, as occasion may require, without disturbing the bearing of the lower wheels on the rails. The engine is also provided with an equalizing truck, so as always to preserve the bearing on the rail.
With this improved construction the running speed may be materially increased without increasing the number of reciprocations of the pistons, and the parts are so arranged that the center of gravity of the locomotive will not be so elevated as to render it liable to leave the track in turning curves.
An increase of the speed of locomotives as ordinarily constructed can be attained only by an enlargement of the driving wheels, or by an increase in the number of the revolutions of the pistons. To enlarge the drivers beyond a certain limit is found objectionable, since by so doing the center of gravity of the locomotive is so elevated as to cause a swaying or gauge motion, and the locomotive is liable toleave the track, especially on curves; and it is found impracticable to materially increase the number of reciprocations of the piston, except at the expense of fuel and a possible straining of the boiler to carry steam at such a pressure as to overcome the backlash or expansion of steam in the cylinders, which cannot, under such circumstances, escape with sufficient rapidity through the ordinary exhaust ports.
In the Fontaine locomotive these difficulties are overcome. We give below a table of the principal dimensions, for which, as well as for our engraving, we are indebted to the Railroad Gazette:

| Gauge of road....... ....... ........................ $4 \mathrm{ft} .88 / 2 \mathrm{in}$. |  |
| :---: | :---: |
| Total wheel base. | $21 \mathrm{ft}$.5 in . |
| Total weight of locomotive in working order. .......... $62,000 \mathrm{lb}$. |  |
| Total weight on driving wheels. | 32,000 lb. |
| Diameter of driving wheels. | 70 |
| Diameter of upper friction wheel. | .72 in. |
| Diameter of lower friction wheel | 56 in. |
| Diameter of truck wheels...... | ...... 42 in. |
| Diameter of cylinder | ...... 16 in. |
| Stroke of cylinder | 24 in. |
| Outside diameter of smallest boiler ring | . 48 in. |
| Size of grate. | 21/8x33\% in. |
| Number of tubes. | ..... 140 |
| Diameter of tubes. | ... 2 in. |
| Length of tubes | $\ldots 11 \mathrm{ft}$. |
| Square feet of grate surf | .141/2 |
| Square feet of heating surface in fire box |  |
| Square feet of heating surface in tubes. | . 806 |
| Total feet of heating surface. | . 906 |
| Exhaust nozzle-single or double. | . Double. |
| Diameter of nozzle . | $\ldots . .3$ in. |
| Size of steam ports | $12 \times 11 / 4 \mathrm{in}$. |
| Size of exhaust ports | $14 \times 2$ \% in . |
| Throw of eccentrics. | .... 5 in. |
| Outside lap of valve. | . 34 in . |
| Inside lap of valve. | ..None. |
| Size of main driving-axle j | .71/2 in. |
| Size of truck-axle jour | 5 in. |
| Capacity of tank | 000 gallons. |

## RECENT INVENTIONS

An improvement in tooth brushes, patented by Mr. Roger S. Tracy, of New York City, relates to tooth brushes having removable pads or brush portions, and the object is to provide a simple, convenient, and inexpensive article of that cbaracter.
Mr. Ernst Schultz, of Berlin, Prussia, Germany, has patented a compound for cleaning and preserving polished wood surfaces, consisting of linseed oil, olive oil, mastic, sulphuric ether, tincture of benzoin, oil of turpentine, tincture of curcuma, and nitro benzole.
An improved grate for stoves has been patented by Mr. John Straszer, of Manchester, Mo. This invention relates more particularly to wood burning stoves of the form known in some localities as the "Tod" stove. The im provement consists in combining a lugged and ribbed recip rocating grate with a stationary grate.
An improved machine for rolling and turning logs has been patented by Mr. William E. Hill, of Big Rapids, Mich. This is an improvement on the construction of the machines for rolling and turning logs for which letters patent No. 233,755 were issued October 26, 1880, to the same inventor.
An improved machine for bending and flaring barrel hoops has been patented by Mr. Erastus Hibbard, of South Barre, N. Y. The object of this invention is to furnish a hoop which will have the proper flare to fit a barrel or tub, and will be of nearly the same thickness at both edges and ready for application to a barrel without work upon it by the cooper; and to construct a machine for manufacturing such hoops, the machine being capable of making the hoops of uniform size, and bending and flaring them at the same time.
Mr. Louis C. Graupner, of Red Bluff, Cal., has patented an improved blind-finishing machine which will bead, rabbet, and joint blinds rapidly and accurately, leaving the to operas of the blind parallel. It can be readily adjusted ing one edge and making the other edge knuckle-fointed or of any other desired shape.

## NEW INVENTIONS.

A device for holding a cuspidor, in connection with a chair or other article of furniture, in such a manner that it can be used very conveniently when desired, but is concealed when not in use, has been patented by Mr. Willard F. Wellman, of Belfast, Me.

Mr. Adrian C. Selby, of Maysville, Ky., has patented an improved soap that is adapted to all of the household uses, for cleaning clothing and fabrics, furniture, tinware, and for toilet use, the properties of the soap being such that it will remove grease, ink, and iron stains from fabrics without changing their color and causing the colored figures of the fabric to run upon the lighter ground. This soap is composed of sal soda, unslaked lime, soft water, bar soap, resin, alum, borax, benzine, salt of lemon, and cream of tartar.
Mr. George Wolfe, of Peoria, Ill., has patented improvements in earthenware pans, such as sauce and stew pans, which have their bails attached in a substantial way, and are so constructed that they are not damaged or broken by the action of the excessive heat. The invention consists in the peculiar means for connecting a bail to such earthenware pan, and in constructing the bottom of the pan with a series of spirally radiating ridges which are of greater depth as they approach the outer edge of the pan, so that the outer surfaces of these ridges rest in a plane, while the bottom of the pan is slightly curved, giving a slightly rising course to the air currents as they circulate outwardly from the center. Mr. Orrando P. Dexter, of New York city, has patented an improved instrument for dividing and subdividing circles an improved instru and angles. It con sists in an instru-
ment combining a series of bars or arms pivoted to a commoncenter, and slide links connect ting the bars.
A lunch box, in which tea, coffee which tea, coffee, and other liquids can be carried an heated, has been pa tented by Mr. Henry B.Dummer, of West Troy, N. Y. The boxisprovided with double bottom and sides forming a space or chamber all around the box all around the bo or holding liquids, which chamber is closed at the top, with the exception of an orifice through which it may be filled and emptied, the orifice being provided with a suitable stopper for preventing the es cape of the liquid.
An improvement in railroad switches has been patented by Mr. Abraham Ayres, of New York city. The object of this invention is to simplify and cheapen the construction of the kind of railroad switches that are operated by the weight of the car horses.
Mr. John T. Crowther, of Carbondale, Ill., has patented an improved dumping car to run upon rails. It may be used in building railways or for carrying ore or coal at mines, or for loading or unloading grain, and for various other purposes.
Mr. Daniel B. Smith, of Topeka, Kan., has patented an improved car coupling formed of a draw-bar provided with an arm on which a lever is pivoted having a block sliding on an upright of the draw-bar suspended from its inner end, the coupling pin being attached to this sliding block, which is connected by a chain with a beveled link guide pivoted to the draw-har, so that this link guide will be raised to the outer end of the draw-bar when the coupling pin is raised thus guiding the link into the aperture of the draw-bar.
Mr. Hans J. Müller, of New York City, has patented cer tain new and useful improvements in electroplating circuits for the purpose of preventing the secondary current of the plating bath from reversing the polarity of the machine. The invention consists in a third or separate line which leads from a piece of carbon or other electric conducting post connected with the end of the magnet wire.
Mr. Joseph H. Wright, of New York City, has patented an improved form of pencil holder for use as an attachment of writing desks. The body of the holder is a box or hollow cylinder having a funnel-shaped or flaring tubular extension to receive the pencil, and adapted for attachment to a desk or some appendage thereof. The cylinder contains a spring reel similar to those employed in a certain class of curtain roller attachments, and the pencil is connected with the reel by means of a cord that is quickly
drawn off or wound up, according as the pencil is required for use or not
Mr. Samuel E. Rusk, of Croton-on-the-Hudson, N. Y., has patented a novel telegraph relay and main line sounder; and it consists, essentially, of a permanent magnet having a movable pole extension surrounded by a helix, the pole extension projecting between the poles of a second permanent magnet and carrying the movable contact of the local circuit. The invention also consists in a local circuit, including a certain amount of resistance a...jitional to that of the sounder magnets, which is either short-circuited or put wholly in the local circuit by the action of the relay.
Mr. William Russell, of Kilmarnock, County of Ayr, North Britain, has patented an improved apparatus for use in the manufacture of Scotch bonnets, etc. The invention consists of an improved " jack" to fashion or shape knitted fabrics while being woven or knitted by a straight bar hosiery frame into circular shaped fabrics.
An improved ice cutter has been patented by Mr. Peter D. Falardo, of Cohoes, N. Y. This invention relates to machines that are operated by steam engines for cutting ice on ponds, rivers, and lakes. It is designed for cutting ice blocks lengthwise and crosswise.
An improved door and window securer has been patented by Mr. William Seeman, of Honesdale, Pa. The invention consists in constructing a window sash fastening with two plates attached to each other at their lower ends and con ected at their upper ends by a swiveled screw, and the pawl hinged to the upper end of one of the plates, whereby

## SLEEPING FISH.

Since the invention of large aquariums the inhabitants of the marine world have been carefully studied in their native element, and many interesting observations and important discoveries have been made. The Berlin aquarium is especially well arranged for the scientific study of fish life, and lately it has settled a much disputed point.
" Do fishes sleep?" has often been asked, but never authoritatively answered. Older investigators denied the possibility, but lately this opinion has been changed in consequence of the following facts.
Generally the life of a fish is more simple and monotonous than that of animals or birds. The fish devotes its time entirely to seeking nourishment. It does not regularly hunt its prey, though it is known that it is much more active at some times than at other times when it seems to rest quietly. This active state is more frequent, as even when the fish is apparently playing at rest it is still ready to seize on any passing prey; but when tired or satiated it remains quiet in way that resembles the sleep of the beasts of prey.
Generally fish hunt night as well as day; indeed some only commence their activity with the twilight, and rest during the day, in certain places, either lazily floating in the water or hidden in the mud, their belly only visible. These facts have been lately proved by Dr. Hermes and others.
In one division of the Berlin aquarium were about a dozen carp (Caprinus carpia) that commence in October to act curiously. From time to time the majority of the fish, occasionally all of them, would assume a crooked position (seeengraving), and remain so forhours, or until they were disturbed. When worms or other food were thrown into the water they would spring up to seize it and immediately resume their old position. These fish were often very particular in choosing their resting places. Some would examine carefully with their heads the surrounding rocks and stones, then slowly turn themselves over on the right or left side, and either remain quiet or swim away to seek some other place. Other fish would lie on the would he on the gravel, resting on theirheads and tails, in the form of a bow. One carp always stood on its head with its bedy erect in the watera veritable wonder of balancing that showed the capabithe fastener can be adjusted to the size of the space between $\|$ lities of its fins. It was easy to arouse most of the fish by the sash and casing, and can be made to secure both sashes Mr. Thornton F. Williams, of Lower Cascades, Oregon, has patented an improved revolving dip net for catching fish as they are ascending streams. It is simple in construction, automatic, and adjustable to the height of the water. Mr. Henry D. Hurley, of Weedsport, N. Y., has patented a convenient and efficient device by which eggs may be tested by means of a stream of light, the eggs being contained in a dark chamber.
Mr. James Baldwin, of Huntington, Ind., has patented n improved ink well which cannot be upset, preserves the nk in good condition, and is simple and convenient.
Mr. John Turner, of Springfield, Ill., bas patented an mprovement in sulky plows, the object of which is to lock the forward end of the plow beam of a sulky plow automat ically when the plow is raised from the ground.

## Improved Tobacco Pipe.

Mr. Jacob H. Van Riper, of 184 Market St., Newark, . J., has lately patented an improvement in tobacco pipes, the object of which is to prevent the entrance of nicotine and essential oils of the tobacco into the mouth of the smoker, and to retain them in the pipe stem. The improvement consists of a sectional pipe stem having two central sections with large bores or chambers for the condensation of the nicotine and essential oils. These are coupled together with a coupling nut of comparative small bore, provided with reduced terminal central bosses, that serve to retain the condensed oils in the pipe stem, the nut being inserted into the opposite ends of the central sections. In frect this improved pipe stem is a doubly chambered reversible stem.
means of food or of a noise, but some of them slept so soundly that it was only possible to disturb them by hitting or shaking them repeatedly. The lidless, always-open eye of the fish makes it difficult to distinguish its sleep from its periods of ordinary rest, but this last experiment was conclusive.
The suggestion that this behavior is the result of illness is answered by stating that this habit of sleep was observed nearly every day for more than six months, and during all that time the fish ate regularly, and were free from any appearance of sickness.
It is possible that, as carp bury themselves close together in the mud during the winter, when they are free in the ponds, this behavior in the aquarium was simply their usual winter sleep, modified by disturbances and their altered mode of life.

## The Geographical Congress.

The first session of the Geographical Congress in Vienna -the third annual meeting-took place September 15. Many explorers and other celebrities were present. The congress was opened by the retiring president, M. De Lesseps. The acting president was Prince Teano, president of the Italian Geographical Society. One of the American delegates, Professor Barnard, of Columbia College, proposed a general meridian for all the world with a system of standard time. The plan is to divide the globe into twenty-four meridians of fifteen degrees each, each comparing with the twenty-four hours of the day, the prime or first meridian to pass through Behring Strait, the hours of the day to be counted from one to twenty-four, the A.M. and P.M. of the present system being abolished.

## engineering inventions

Mr. James Manes, of Denver, Col., has patented an im proved machine for pulverizing and amalgamating ores. his invention relates to a machine for extracting gold and silver from their ores or from tailings. It consists, mainly, in a series of metal cylinders placed horizontally and made cone-shaped or tapering, so as to be larger at one end than at the other, the said cylinders being provided at their large ends with detachable heads, and being arranged with the large end of one above the small end of the other, and the cylinders being connected by spouts arranged alternately at opposite ends, so that the ore travels by gravity down to the larger end of the cylinder and enters the smaller end of the next subjacent cylinder, and in each of which cylinders is arranged a rotary slaft bearing mullers, brushes, or other devices for pulverizing, stirring, and mixing the ore with mercury or other chemical as it passes through the machine. Mr. Jacob J. Anthony, of Sharon Springs, N. Y., has patented a new and improved car truck, which is strong and durable, and has a broad spring-bearing for the car body, and which prevents undue wear of the wheels and rails at the curves of the latter.
An improved furnace for steam boilers has been patented by Messrs. Josef Nitsche and Theodor Grellneth, of Vienna Austro-Hungary. This invention may be carried out in various ways, but the main feature in all is that a part of the air which passes through the grate and is thereby heated, is led to a passage or chamber, whence it, at a cer tain height above the grate, is made to meet the gaseou products of combustion before they escape over the bridge The carbon particles which have not been consumed, or the carbon which bas only been formed into carbonic oxide and otherwise escaping into the chimney, are thus again brought into contact with the oxygen of the heated air, and thus completely burned.
An improved steam engine valve has been patented by Mr. William Hopkins, of Dubuque, Iowa. This invention relates to that class of valves known as "steam actuated steam valves," that are operated by steam and not by me
hanical attachments.
Mr. Robert Holbon, of Alpena, Mich., has patented an improvement in car couplings, which consists, principally in providing the draw heads of each of the cars with hori zontal draw bolts, upon which are pivoted the spring actu ated bevel-headed connecting bolts, which may be simul taneously operated irom either of the cars for disconnecting the same by means of double-acting tumblers.
An improved side bar for locomotives has been patented by Mr. John R. Fish, of Grand Rapids, Mich. The object of this invention is to prevent the side bars of locomotive from breaking in cold weather. The invention consists in a
side bar connecting the driving wheels of a locomotive, having longitudinal strips of wood attached thereto parallel therewith to break the shocks or vibrations caused by irregularities of the track.
A breakwater for protecting harbors and roadsteads, and keeping open channels through bars at the entrances of harbors, the mouths of rivers, and in other places, has bcen patented by Mr. Alexander G. Follett, of Velasco, Texas.
Mr. Wendel Collin, of Pitsburg, Pa., has patented an improvement in car couplings, the object of the improvement being longitudinal a coupling which will lock auto matically, and may be unlocked from the platform, sides, or top of the car. It may be used where the cars differ in height.
Mr. David Nevin, of Silver Cliff, Col., has patented an improved stamp guide for ore mills, which is durable easily kept in order, and it provides better facilities for taking out stamps and changing and repairing guides as they wear out.

## The Absecom Beacon Light.

There are a few great beacon lights on the Atlantic coast that are known by the mariner the world over. One is at Hat teras, others at Cape Ann, Cape Cod, Grey Head, Minot's Ledge, and Nantucket, and another at Absecom. This great Absecom ligbt at Atlantic City, furnished by a Fresnellens of the first order, which gives a mass of light six feet wide and ten feet high, burns steadily from sunset to sunrise, and can be seen from the deck of a vessel twenty miles at sea. It is a fixed white light, exhibited from the top of a tower 167 feet high, and is visible all round the horizon. To protect the tower thousands of tons of stone and huge dikes are placed on the seaside, but the washing of the waves seriously hreatencd it, until three years ago a pier was constructed long distance out to sea, and since then the land has made, removing the beach hundreds of feet away from the towe and the town. About twenty-five years ago a huge package was sold by auction in New York for unpaid custom duties, and brought about $\$ 200$. It had been consigned in France to a person who had never called for it. Being opened, an immense Fresnel lens of the highest order was found, and this is now the Absecom light. It had cost the Government about $\$ 11,000$, and they thought it was lost. Let us make this great lighthouse a visit. Major Wolf, the keeper, live in a modest brick building at the foot of the tower. He is bird fancier, and has a large lattice-work house near by with almost a hundred pigeons, many of them carriers, and
some of them most amusing tumblers, while over the some of them most amusing tumblers, while over the
assemblage presides a solemn wild goose. As we signed the book a pretty little rose-breasted grosbeak, which had been caught in the netting outside the lantern, chirped merrily in its cage. Were it not for this netting the birds flying
against the lantern at night might break the glass. Asit is many are caught in the netting. The Major said he once caught seven brant at one time, and they had thus captured as many as 300 birds in a single night.
Let us climb laboriously up the winding stairs of the gradually narrowing tower, and count 228 steps as we ascend. It is a tough job even for the keepers who are used to it, and the climber winds around and around the twisted stairway, until he gets almost into the condition of the whirling dervish. The stairway finally comes to an end in a little room beneath the lantern, and on a level with the balcony outside the tower. Here they sit at night serving four-hour watches, and as the tower vibrates in the wind they superintend the light above. We go up into the lantern and see the wonderful construction that makes this powerful light. Imagine yourself in the chimney of a mammoth amp, ten feet high and six feet across, the central part of the sides made of thick curved glass, and all the rest, top and bottom, of curved prisms acting as a multitude of reflec ors. In the center is a large lamp with four circular wicks, arranged regularly one inside the other. Above and below are huge reservoirs of lard oil, with pumps moved by clock work which regulate the supply. Two gallons of oil are burnt in a night to keep up this artificial sun for the mariner, which outshines any other light that has yet been adapted for lighthouse use
The view from the top of this tower is grand. Far out to sea the haze over the water obscures the junction of the cean and sky, but vessels spread their white sails in all directions.

## Draining a Bog.

The following account of draining a bog in Holland w furnished the Times of London by a local correspondent
My steps were directed to the well-known reclaimed estate Mr. Nering-Bolger, called Principell, about two miles from the little station of Mill, on the Boxtel-Wesel Railway The entire estate is of 1,500 acres, and cost Mr. Nering $£ 10,000$ about twelve years ago, he having paid that sum for it when in the original bog state to the community of Mill. Mr. Nering, in the meantime, went over to North German and studied the methods of reclaiming bog lands as followed at or near Osnabriuck and Arenberg-Meppen, and other places, and after a careful study of those methods returned home, determined to make the experiment on a bold scale.
Bold it certainly was, for in addition to his $£ 10,000$ paid down as purchase-money of 1,500 acres of a treeless waste of bog, it cost him $£ 12,000$ more in draining, labor, manures, and putting up the requisite farm-buildings, including his own residence. As Mr. Nering truly told the writer, those in Holland who have the money will not enter upon experiments of this kind, and those who have not the money cannot The general plan of the estate has been to select 1,000 acre or reclamation, which has been done, while the remaining 500 acres are left for future operations, when Mr. Nering's convenience may permit. In the meantime he prefers to wait the result of his 1,000 acres and the experience he will gain year by year before he attempts to reclaim the remain-
ing 500 which will also supply him with fuel for himself and the fifty men or so who work the farm for him. Mr Nering commenced operations about eight years ago, by cut ting suitable ditches and roads, all in parallelogram form thus dividing the 1,000 acres into four divisions of about 250 cres each, and each division again subdivided into suitable plots for drainage and cultivation purposes. For each of the four principal divisions Mr. Nering built a suitable farm and outbuildings for stock, etc., and over each division he appoints a farmer, who is put upon his mettle by being made kind of partner, his remuneration depending entirely upon the results of the land under his care. The whole estate is closely supervised by Mr. Nering himself, assisted by an intendant or bailiff. I, of course, could not see more than the springing crops which, however, seemed quite as backward as in England, many of the fields of oats and maize especially having only just been sown; but the cattle were in capital condition, and Mr. Nering seems inclined to devote
himself largely to stock for the development of his estate and for present and ultimate profit. The manure of the beasts is, of course, all used in the cultivation of the land, and as the stock increases, Mr. Nering is enabled to do with ess of some of the chemical manures with which he began he experiment after the methods of the Osnabrick and North German school of waste-land reclamation. The land ields capital pasture of grass and clover.
This brings me to the main point of the experiment, viz. the use of chemical manures, which is a melhod that has only been practicable since the great $\cdot$ potash deposit dis coveries in the Stassfurth district and Anhalt duchy some dozen years ago, or rather more. Prior to those remarkable discoveries of potash salts in various combinations, the supply of this fertilizing material was limited to costly methods and sources, which made the article too dear for agricultural purposes of this kind, and this discovery may truly be said to have come in time to revolutionize the agri cultural procedure in the reclamation of bog land. The method pursued is to dig broad ditches, to drain and to divide the bog into suitable plots, and at the same time to supply the requisite amount of sub sand to put an even layer of four or five inches in thickness on the neighboring plot of oog land. Mr. Nering then spreads upon the sand after slight working of it his mineral manures in the following proportions-viz., of kainit, which is a double sulphate of potassium and magnesium, about 240 pounds per statute acre
which costs 5 s . for 200 pounds, including carriage from Stassfurth. He also uses about 80 pounds of nitrate of soda per acre, which costs him about 30 s. for 20.3 pounds, and then he uses a fair proportion of the more costly, but necessary, phosphate of lime, which he makes himself by first buying bones at about $£ 4$ to $£ 5$ per ton, and mixing them with sulphuric acid.
Mr. Nering uses large quantities of his farm-yard manure, and finds it better to put the farm-yard manure separately on his land, because of the difficulty of evenly mixing it with the mineral manures. These latter he therefore applies as guano is sometimes or generally applied-that is by scatering it with the hand, thereby insuring a tolerably even distribution. He has experimented with various quantities of the kainit per acre, having used as much as 400 pounds per acre; but as he did not find any proportionate advantage, he of course now restricts himself to supplying only 240 pounds per acre. Mr. Nering suspects that the potash and nitrate soon pass away, from their soluble natere, into the drains, and so into the river. Notwithstanding this, he is amply satisfied with the profitable results of his experiments, which have shown a steady four to five or six per cent on his capital outlay per annum since 1875, aknough the latter seasons have not been propitious in Holland any more than in the British isle.
In a recent pamphlet Mr. Nering's example is cited as a notable example of the North German and Dutch method of bog reclamation, and the assertion is made that Mr. Nering had realized in one year (1875) a net profit of twenty-two per cent on his outlay. I took the opportunity of calling Mr. Nering's attention to this statement, asking if it were really true, and he at once declared that he had never realized more than the modest four to five or six per cent I mentioned before.
Any way, the truth is that Mr. Nering's experiment is a substantial success, and it is well that the error just mentioned has been discovered and rectified at a moment when the Irish land question is to the front, and when, no doubt, vast sums of the public money will be asked for and probably voted for reclamation of bogs in Ireland. It is of the first importance, therefore, that the facts should be known, both in the interests of the Irish and the other nations form ing the British Isles. I especially put the question to Mr. Nering as to his opinion of the conditions requisite to a bog being reclaimable, and yielding a reasonably profitable return. He distinctly gave his opinion that the first requisite is that the land can be drained successfully, and the second that the bog is not deeper than five feet, or six feet at the outside; further, that it should rest on sand or on marl, but not on stifl yellow clay; the marl, to be spread on the surface of the bog, would weather and fall under the frosts and rains, and would, like the sand, give the requisite top-dressing upon which the chemical manures could be spread. But if the bog is more than five or six feet deep, it must be pared down to that depth before there can be a reasonable prospect of profitable reclamation, and if that can be done and the water can be drained away, the experiment, properly conducted, must be a success. Mr. Nering's land is, in fact, a mere skin of turf or bog of from one foot to certainly not more than three feet in depth, and probably not averaging more than two feet, and this rests on a hungry sand such as might have been left on the shore of an estuary.

## History of the Screw Propeller.

The erection of a monument to Sauvage, who is believed to be the first to have practically applied the screw propeller to the driving of ships, has given rise in France to a discussion of the true history of the propeller, and the interesting fact has been elicited, says Engincering, that it was actually applied on a small scale by Leonardo da Vinci about the end of the fifteenth century. That great artist and engineer endeavored all lis life to find a means of flying; and though his admirable studies on the flight of birds are well known, few are aware that he invented several apparatus for elevating man above the ground and wafting him through the atmosphere. All these solutions of the aerial problem are independent of the principle of levitation, and aim at realizing flight by apparatus heavier than the air. among these numerous plans, which can be seen in the "Codice Atlantico" deposited in the Ambrosian Library of Milan, and also in the volumes belonging to the library of the Institute at Paris, there is the decign of a large screw destined to turn round a vertical axis, beside and below which are written some notes in Italian to the effect that the hread of the screw should be of iron wire stiffened with light supports, and covered with linen cloth having its pores stopped with gum. According to the author, when this screw is rapidly turned, it mounts into the air. The design is a very rough one, but it is perfectly clear, as may be seen at page 401 of the Comptes Rendus for August 29. We see, therefore, that Leonardo da Vinci in all probability invented the screw propeller, and first applied it to aerial locomotion, hereby anticipating M. Tissandier in his recent application of the same device to a balloon by means of stored electricity. The latter employs bamboo for the framework of his screw, and curiously enough the Italian philosopher also suggests he use of long stout reeds. Moreover, on consulting the "Saggio delle Opere di Leonardo da Vinci," published at Milan in 1872, M. Govi finds that that universal genius had studied the effort exerted in striking the air with plates of a given size, and also invented the well-known parachute, of which a rough design is given, showing the figure of a man clinging to it.

While The Tehuantepec Ship Railway
While the preliminary works of the Panama ship canal are in progress-though, according to the imperfect information afforded, the progress is very small and the difficulties far greater than were foreseen-Captain Eads is earnestly
developing his project for the construction of a ship railway across the isthmus at Tehuantepec. The abilities of Captain Eads, both as an engineer and a financier, have been too well established by the successful completion of one of the great engineering works of the world-the deepening of one of the mouths of the Mississippi-for this scheme to be passed lightly on one side, and pronounced chimerical; on the contrary, emanating from such a source it commands the most serious attention both in a professional and a commercial point of view; it would be at once the most original and boldest engincering work ever attempted, and if successful would have an incalculable effect upon the carrying trade of America, and to a less extent upou that of the whole world. In the United States the question is one attracting great attention, for not only is the work of M. De Lesseps generally regarded with a feeling of mistrust, and with a sentiment of jealousy also, but the route located by Captain Eads lies so much nearer the direct line of travel that it would naturally absorb nearly all the trans-isthmian traffic.
On a subsequent occasion we shall consider this point in more detail, but at present we will content ourselves with a few figures relating to the two routes. Speaking roughly the ship railway route is at the north and the ship canal at the south of the isthmus connecting the two continents, the 'ines of crossing being about 1,100 miles apart. This is a matter of the utmost importance, especially since Captain Eads has opened for large ships the great waterway of the United States, and converted New Orleans into a vast seaport. A ship leaving the mouth of the Mississippi for California, Japan, or China would, if intending to cross the isthmus by the canal, after passing the site of the railway, be obliged to follow the coast for 1,100 miles to reach the canal, and having crossed, pass up the coast on the western side for the same distance before reaching Tehuantepec. Thus the voyage would be necessarily 2,200 miles further than by the ship railway. This would represent a saving of about nineteen days on a round trip between New Orleans and San Francisco, and a saving of twelve days on a round trip between New York and San Francisco. Shipowners and merchants alike will understand the practical results of such an economy.
Although Captain Eads' project bas not yet advanced so far upon the ground as that of M. De Lesseps, it stands upon at least as firm a foundation, and its ultimate prospects are probably far brighter, apart from its physical advantages. The concession granted by Mexico to Captain Eads is a peculiarly advantageous one, the estimate for construction is only $£ 15,000,000$, as compared with $£ 48,000,000$ for the canal, and if these figures are insufficient, the excess of cost in each case will probably be in the. proportion of the estimates; the work could be completed in four years, and there is no doubt as to the amount of traffic which would await the railway on its completion. Naturally the undertaking will meet with much political opposition in the United States, but on the other hand it will meet with widespread and powerful support. The chief opponents will be those whose material interests lie in preserving railway monopolies, and preventing the carrying out of any work which, no matter how vast the national benefit resulting from them, would produce competition and destroy monopoly. On the other hand, support will come on all sides from those who desire the welfare of the country, and who also have great material interests at stake, such, for example, as the merchants of New Orleans now possess. Under these conditions we think there is little doubt but that the Uuited States Government will accord the guarantee asked of six per cent on two thirds of the capital for a maximum term of fifteen years, subject to conditions which throw the whole responsibility on Captain Eads, and also to special advantages which would well repay them for a guarantee which they might never be called upon to redeem.-Engineering.

## Recent Elevation of the Himalayas.

The superintendent of the Geolugical Survey, Mr. H. B. Medlicott, and the deputy-superintendent of the same work, have prepared a manual of the geology of India, in two large volumes. With regard to the movements producing the Himalayas the authors say: "During the interval that has elapsed since Eocene times, while no important movements, except small and partial changes of elevation, can be traced in the Peninsula, the whole of the gigantic forces, to which the contortion and folding of the Himalayas and other extra-peninsular mountains are due, must have been exercised. The sub-Himalayan Eocene beds were deposited upon uncontorted Paleozoic rocks; and, although the Himalayan area was probably in great part land at a much earlier period, there is no reason for believing that this land was of unusual elevation, while the direction of the Himalayan ranges is clearly due to post-Eocene disturbance. It will be shown, in the chapters relating to the sub-Himalayan rocks, that the movement has been distributed over the Tertiary and post-Tertiary period; and a great portion is of postPliocene date. Indeed, the fact that earthquakes are now of common occurrence in the Himalayas, the Assam hills, Burma, Cutch, and Sind, and that many of the shocks are severe and some violent, while the peninsula area is but rarely affected by earthquakes, may indicate that the forces,
to which the elevation and contortion of the Himalayas are due, are still in action; and that the highest mountains in this world owe their height to the fact that the process of
elevation is still in progress to a sufficient extent to counter balance the effects of denudation.

In Sind and the Suleman ranges, there is much probability that some movement took place during Miocene and Pliocene times. Some slight unconformity between beds, elsewhere conformable, and the absence of different groups in parts of the country, may thus be explained; but the principal disturbance is clearly of post-Pliocene date. To the eastward, in Burma, however, the Pliocene formations of the Irawadi valley are but little disturbed, and the Miocene beds, although contorted, are unaltered; while many of the Eocene and Cretaceous rocks are greatly changed, besides having undergone excessive disturbance and folding. These facts may, perhaps, indicate that the disturbing forces were more severe to the eastward in middle Tertiary times, and that the main action to the westward was of later date; view partly supported by the fact that there is evidence of elevation having taken place in the Himalayas, near the Ganges and Sutlej, at an earlier period than farther to the westward. In the Simla area there is marked unconformbetween the Sirmúr and Siwalik series, and between the lower, or Náhan, group of the Siwalik series itself and the next overlying subdivision; whereas farther west, in the Northern Punjab, all the groups follow each other in appar ently comformable sequence. The evidence, however, is not sufficient to prove that the contortion to the eastward older than to the westward; and the absence of any impor ant break in Burma is opposed to the suggestion of great movements having tak

It is evident that the forces, to which the principal ranges in the extra-peninsular area owe their direction, have not only been exerted throughout a considerable portion of the Tertiary period, but that these forces have acted contempo raneously, at all events in the post-Pliocene period."

## Antarctic Ice.

Mr. Buchanan made experiments on the melting poin and amount of salt contained in salt water ice.
He came to the conclusion, from analyses of successive meltings, and the varying of the melting point, that in salt water ice " the salt is not contained in the form of mechanically inclosed brine only, but exists in the solid form, either as a single crystalline substance or as a mixture of ice and salt crystals."
He thinks that by fractional melting salt water ice might be made to yield water fit to drink, although when a lump s melted as a whole the resulting water is undrinkable
We crossed the Antarctic circle on February 16, passing about six miles to the south of it. There was open water ahead, but the Challenger was not strengthened for ice work, and we were not ordered to proceed further south, so we turned back.
There seemed to be a deep opening in the pack here nearly due south of Heard Island.
We subsequently passed within six miles of what is marked on maps as Wilkes' Termination Land, and found that this did not exist.
Wilkes, no doubt, was deceived by the land-like appear ance of distant icebergs.
It is to be noted that he merely says that he saw appearance of land here, sixty miles distant, but high and mount ainous. Otbers have named it for him and placed it on the charts. -H. N. Mosely, Challenger Notes.

New Lead Process for the Extraction of Gold from
The tall chimneys of a large building at the foot of West Fifteenth street, New York city, have attracted some attention of late. An Evening Post reporter who investigated the building found that it contained machinery designed to extract the precious metals from ores and tailings by a new process which is said to be a great advance upon all previous thods.
Mr. Hamilton, the inventor of the process, said: "The whole thing lies in the affinity of lead for silver and gold. It was discovered, many years ago, that if into a bath of melted lead you plunge a piece of gold or silver heated to the same temperature as the lead, it will disappear so fast that you cannot see it melt. The extraordinary thing about it is that lead will melt at $630^{\circ}$, while silver only melts at about $2,000^{\circ}$; yet, if you take a bar of silver as thick as your finger, and, after heating it to $650^{\circ}$, plunge it into a bath of lead at $650^{\circ}$ you cannot withdraw it fast enough to save it; whatever part has touched the lead will have disappeared.

The great trouble that I have experienced in my years of experimenting has been that if I crushed my ore and plunged it into melted lead it would not stay there long enough for the lead to get through the mass of ore to the metal. The ore is about thirteen times as light as the lead, so that it would rise instantly to the top. I could succeed in small quantities, but for practical working in which hundreds of tons of ore would be used every day, the difficulty of mixing together two substances of so unequal density as lead and ore was found almost insurmountable. I think that I have succeeded at last by means of a certain apparatus
contained in a furnace of brick and cast iron. Thelead has an ample chance to reach each particle of ore and extract all the gold and silver. Everything will be done automatically
from the time the ore arrives until the lead containing the gold and silver is poured out to cool. We expect to reduce ton every ten minutes at a cost of one dollar."
Mr. Hamilton then showed the reporter through the works, in which nearly one hundred men are employed fitting the machinery together. As about thirty-five tons of molten lead are used in this machine, it has to be of the most substantial character. The furnace for heating the ore and the blast fires for furnishing heat are all enormous structures.

## MISCELLANEOUS INVENTIONS.

Mr. J. N. Proeschel, of Milwaukee, Wis., has lately patented an improvement in firearms which consists mainly in the combination, with the usual self-cocking lock, of a concealed rigger readily projected from a small guard by a pressure of the thumb or finger. This arrangement, by doing away with the usual open guard and projecting trigger, notably diminishes the bulk and weight of the lock while increasing the safety in handling and carrying the arm. While the invention applies to all firearms, the advantages which it affords when applied to revolvers are especially noticeable. affords when applied to revolvers are especially noticeable.
These advantages are, of course increased safety and dimiThese advant

An improved machine for treating grain has been patented by Mr. Cbarles T. Schramm, of Pontoosuc, Ill. The invention consists in combining an air flue and sliding screens, the flue provided with two openings and hinged plates.
Mr. George W. Logan, of New York city, has patented an improved hat and clothes rack which can be folded very compactly, and the arms of which can be raised, lowered, and locked at any desired inclination very conveniently and quickly.
An improved attachment for cloth-shearing machines has been patented by Mr. David McColl, of Cleveland, Teun. The object of this invention is to take the curland slack out of the selvages of cloth, so as to present a smooth, even surace to the shearing cylinder.
Mr. Jobn Brunny, of Fort Scott, Kan., has patented an improved calf and cow weaner. The invention consists in a wire pointed at the end, bent to form a hook, a spring coil, and two angles, and baving a pointed wire attached to it in line with its pointed end, the wire bent into a loop at its center, coiled around the main wire, and having its pointed ends projecting. The device is to be applied to the nose of the calf.
Anchor chains are usually connected to the shank of the anchor by a ring or shackle that is held on the end of the shank by a pin or bolt. With that manner of connection the chain frequently fouls with the anchor and prevents it from holding. Mr. John J. Moule, of Fishkill-on-the-Hudsou, N. Y., has patented an improved shackle bar for anchors, which prevents anchor chains from fouling without limiting free movement of the chain and anchor

Messrs. Daniel W. Shaw and Pleasant W. Brown, of Murfreesborough, Tenn., have patented an improved steam engine. The object of this invention is to economize steam and to cause a constant equal pressure or strain upon the driving shaft of the engine. The invention is an improvemen't on steam engines having more than one movable piston working in the same cylinder, each of which is separately connected with the crank shaft.
Lizzie I. Jones, of Texarkana, Ark., has patented an improved portable bath tub, which when not in use can be compactly fulded.
An improved car coupling has been patented by Mr. Nicholas Barr, of Cayuta, N. Y. The invention consists in the peculiar construction and arrangement of the parts, whereby all danger of accident in coupling and uncoupling cars is avoided.
An improved lumber wagon has leen patented by Messrs. John G. Seifer and John Maschek, of New Orleans, La. The invention consists, essentially, in a novel construction and arrangement of the reach and connections, whereby provision is made for extending and contracting the length of the wagon to accommodate it to long or short lumber.
An improved thill coupling has been patented by Mr. Clarence J. De Witt, of Havana, N. Y. The object of this invention is to lessen the labor and time required in removing or replacing the thills or pole of a vehicle. It consists in dispensing with the removal of the ordinary bolts, eyepieces, and rubbers, and providing each thill or pole iron with a loop, through which the projecting end of an eyepiece is passed and secured to the thill or pole iron by a bolt passing through the thill or pole iron and secured by a thumb nut.
Mr. Hiram A. Laws, of Thompson's Station, Tenn., has patented an improved car coupling provided with a lever having double book at the front end, a fulcrum near its rear end, with a shoulder against which rests the end of a spring for throwing the hooks into engagement.
An improved hoisting machine has been patented by Mr. Henry Field, Jr., of Ne w Bedford, Mass. The arrangement of the parts of this elevator or hoisting machine is such that, by means of a continuously rotating wheel or pulley and link-and-Jever mechanism, and friction and clutch mechanism, the action of the machine and the weight will always be under sudden and easy control with the outlay of very little power upon the governing lever.
An improved windmill has been patented by Mr. Isaac M. Steward, of Stromsburg, Neb. The object of this invention is to insure a uniform speed from a variable wind, and also space.
up the leaves, then dry in the oven; but it smokes too strong. A. Try the following: Thoroughly wet the
tobacco, then pack and put under strong hydraulic tobacco, then pack and put under strong hydrallic
pressure, after which spread it out as soon as possible in thin layers to dry quickly in contact with cool dry
(8) C. A. S. asks: How much power will antember 3 develop in in Scientific American of September 3 , develop in connection with an electro-
motor: Or how many cells would be required to develop one horse power, constant use ten hours per
day? Is there a better battery for this purpose ? A. day? Is there a better battery for this purpose? A. A.
This is matter of experiment we have not sufficient This is a matter of experiment we have not sufficien
data at hand to make the required estimate. The Grove data at hand to make the required estimate. The Grove,
Ladd, Bunsen, and similar forms of battery produce Ladd, Bunsen, and similar forms of batery prode
currents of greater electronotive force, but they require very much more space and attention, and cost more to maintan.
(9) F. H. G. asks: 1. What is the best way of preparing a solution for silver plating, and the one Soft water, 1 gallon; cyanide of potassium, 8 ounces nitrate of silver, $51 / 4$ ounces. Dissolve the silver nitrate
in a small quantity of soft water, and gradually add in a a mall quantity of soft water, and gradually add,
with constaut stirring, solution of cyanide of potassium until no further precipitate of silver cyanide form (avoiding any excess of the precipitant). Throw the
precipitate on a fine cotton cloth fiter and as the liguid runs through wash the precipitate on the cloth with pure water. Mix and dissolve this wasted precipitate with the water in which has previous!y been dissolved the cyanide of potassium. If the silver cyanide does
not dissolve readily add more cyanide until it does. 2. not dissolve readily add more cyanide until it does. 2
Isit necessary to use pure silver both for making soluIsit necessary to use pure siver both for making siad the
tion and for anodes? What effect does it have if the tion and for anodes? What effecter
siver is not pure $\%$ A. Yes; if the siver used is im obtain a reguline deposit of pure silver from such a bath. 3. What battery is the best for silver plating?
A. The Smee form is generally preferred for fine work. See article on Silver Deposits, page 81, vol. xliv.
(10) J. J. R. asks: 1. Can you inform me of any way of silver plating iron or cast steel polished Thaces, without irrst depositing a copper surface of the usicl on Silver Plating, page 81, vol. xliv. 2. Is there
arl not a solution or solutions that remove the saponified
greasefrom the surface of the article to be plated which leaves it immediately ready to receive a deposit of silver? A. Iron and steel can only be satisfaciorily freed from the last traces of oxide-after rinsing in hot
water on coming from the lye dip-by scouring. If properly pickled and scoured in the firstplace the pieces
(11) G. P. H. asks how to make a good quality of court plaster. A. Soak isinglass in a a little
warm water for seventy-four hours, then evaporate warm water for seventy-four hours, then evaporate
nearly all the water by gentle heat, dissolve the residue nearly all the water by gentle heat, dissolve he residue
in a little proof spirits of wine, and strain the whole In a itrle proof sipits of wine, and strain the whole
through a piece of open linen. The strained mass should be a stiff jelly when cool. Now stretcc a a piece of silk or sarsanet on a wooden frame, and fix it tight with tacks or packthread. Melt the jelly and apply
to the silk thinly and evenly with a badger hair brush $A$ second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of bal lam of Peru. Plaster thu
(12) E. Y. asks how to make a cement for glass that will resist acids. A. Take $101 / 1 \mathrm{lb}$. of pul-
verized stoneand lass, and mix withit 431 b . of verized stone and glass, and mix with it 434 lb . of sul of heat that the sulphur melts. Stir until the whole becomes homogeneous, and then run it into moulds
When required for use it is to be heated to $248^{\circ}$ at When required for use it is to be heated to $248^{\circ}$, at
which temperature it melts, and may be empioyed in which temperature it melts, and may be emp.ayed in
the usual manner. It resists the action of acids, never changes in the air, and is not affected in boiling water At $230^{\circ}$ it is said to be as hard as stone.
(13) X . asks how to mould ornaments for paterns for stoves, vases, etc. A. The following com-
position is commonly used: Soften 13 lb . of good glue position is commonly used: soften 1:1b. of good glue
in water enough to cover it, then heat until the glue is dissolved. Melt 71 l . of resin, $1 / 2 / 2 \mathrm{lb}$. of pitch. and $2^{1 / 2}$ pints of linseed oil together. Stir the hot glue solution into this and add enough whiting to thicken. It
sould be mixed in mall should be mixed in small quantities and nsed at once,
otherwis it will require steaming before it can be used
(14) O. E. M. wants to know how to bleach straw. A. Straw goods are bleached by submitting
them to the action of the vapor of burring sulphurthem to the action of the vapor of burving sulphur-
or better, to the vapor of burning bisulphide of carbon. or better, to the vapor of burning bisulphicte of carbon.
The straw, which must be perfectly clean, must be well The straw, which must be perfectly clean, must be wel
moistened with pure soft water before submitting to moistened with pure soft water before submitting to
the sulphuric oxide. The bleaching is carried on in tight wooden sheds. Straw may be bleached by chlorinated lime, but the fiber is liable to be somewhat in jured thereby. Moisten the goods thoroughly in a strong aqueous solution of the bleaching powder (de-
fecated), and then pass them through a bath of sulfecated), and then pass them through a bath of sul-
phuric acid diluted with about 20 parts of soft water. phuric acid diluted with about 20 parts of soft water.
Repeat if necessary, and finally rinse thoroughly in sulphite of soda.
(15) A. W. M. wants to know what is the best generat antidotet to poison. A. If a person swal-
lows any from havng overloded the tomach an intantan remedy most efficient and applicable in a large number of cars, is a heaping teaspoonful of common salt, and as ruch ground mustard, stirred rapidly in a teacupful of water, warm or cold, and swallowed instantly. It is ccarcely down before it begins to come up, bringing with it the remaining contents of the stomach. And lest
there be any remnant of the poison however small, let the white of an egg or a teaspoonful of strong coffe an articles nullify a large number of
(16) "Photo" asks for a good receipt for retouching varnish. A. In his recent work on retouching, M. Janssen, the Photo Corressondenz says, recom-
parts; sandarac, 110 parts; camphor, 2 parts; Venetia
turpentine, 4 parts; oil of livender 3 , turpentine, 4 parts; oil of lavender, 3 parts. This var
nish may also be used for paper pictures. The re toucher should not set to work as soon as the negative has been varnished, as the film will not then be hard enough to bear the touch of a lead pencil. The var
nished film is in the best condition for retoching when a day old.
(17) E. J. writes: I am overrun with rats and mice, and as yet have found no remedy. Can you ator : A Try the follewing: $A$ mityure of two part of well bruised common squills and three parts of finely hopped bacon is made into a stiff mass, with as muc neal as may be required, and then baked into small
(18) H. E. K. asks for a cheap way cheaper than by windmill) to raise half of the wate
from a spring that throws two and a half gallons of watera minute, up to the house five rods distance, te feet high. A. We know of nothing that will answer your purpose. A hydraulic ram will raise only about one
(19) L. B. asks: 1. What is the horse power of a norizontal tubular boiler 10 feet long, 42 inches diameter, 38 -inch tubes? A. Your boile would be usually called 25 horse. 2 . Can I get more power of an engine with a larger fly wheel tian a a malle ne? I have an engine, $8 \times 12$ inch cylinder, and hav 5 foot fly wheel, weighs abont 600 lb . Can I get more and what size; or will it do as well to add anothe wheel of 600 lb . weight on the other side of the shaft The engine makes about 140 revolutions in a minute A. You cannot increase power by more fiy wheel. Yo
an only equalize speed. If the powtr is not uniform it ight be well to add another wheel
(20) P. R. writes: 1. Suppose a sash and ts counterweight to weigh 100 lb . eacl, the pulley to support 200 ib. Then, whi he therin on any part of the cord be 200 lb .9 If not, please explain. A. The ten-
sion on each side of pulley will be 100 b., and total weight on pulley 200 lb b. 2 . Why could not the andes of the East River Bridge be kept higher in the middle and consequently the bridge, as the greatest objection is
because it is too low; or is it necessary to have certain because it is too low; or is it necessary to have a certai amount of sag in the cables? A. To do so would neces
sitaie carrying up the towers to a greater height. The sitaie carrying up the towers to a greater height. Th
cables cannot be straightened without enormously in reasing the strain.
(21) C. C. G. writes: Please inform me approximately the quantity of coal a 25 horse powe
engine run to its full capacity would use in twenty-four engine, run to its full capacity, would use in twenty-four
hours; also, how much water it would require? A. I depends much upon the character and condition of the engine and boilers. An average would be 100 to 130 lb . coal, and 750 to 950 ib . water per hour.
(22) T. J. M. asks: Why is it that an in jetor attached to a steam boiler of 12 horse capacity and running under a pre esure 50 1b., will not raise water far failed and a competent (so regarded) engineer say feet is the limit. If this be so what is our best resor
to accomplish the work indicated ? A. The very best to accomplish the work indicated? A. The very bes
form of injector will not raise (or lift) water reliably one half of 50 feet. If it would produce a vacuum, could note be relied upon to lift water higher than good pump, say 26 or 28 feet. We think your best wa will be, to set a pump in the well about 22 to 25 fee
bove the surface of the water and lift the water into ove the surface of
(23) R. E. M. wants to know how to make alaster cast from the human face. A. Place the sub ject upon his back, with the head raised to the norma position by a pillow of bran or sand; cover the parts in tended to be cast with a flm of olive or true almond oil applied with a feather brush or lump of cotton; plug pieces of glass tubing in the nostrils and secure the space around them with cotton. When all is ready mi the plaster of Paris with warm water to about the con sistence of cream, and with this cover the face from the forehead downward to the lower border of the chin The eyes should be firmly closed, but in such a manne as not tocause distortion by too violent compression
Then cover the parts of the chest and arms to be repre sented, carrying the plaster upwards, so as to join the cast of the face. Then (when properly set) carefully remove each, and soak or brush it with linseed oil brile with a little sugar of lead or litharge. Instead of cast-
ing the face and chest in two separate pieces, it is pre ing the face and chest in two separate pieces, it is pre
ferable to make the casting in one piece, and to divide ferable to make the casting in one piece, and to divid threads placed in position before the plaster is applied and withdrawn when the latter has nearly set. The ca of the back of thehead is usually taken by lowering it (well oiled) into a deep trencher partially filled with th liquid plaster, and the back of the neck with the sub ject face downward. When the mould is inished it amly tied together, the joins plagged wha a little co tity of tolerably fuid plaster poured in winent quan outer portions of the model have nearly set the inne portions are scooped out, and the whole thoroughly dried before removing the mould. The model is trimme with a sharp knife. If the eyes are not to be repre
sented as closed they must be carved out from the
(24) G. L. asks how to temper large curved dies for cutting iron and steel plate. A. Fill the hole with fire clay and wire to keep it in place. Heat evenly
and slowly in a furnace. Lift the dies from the fur nace with the face ve-sical and plunge vertically into water heated to about $50^{\circ}$ and containing about $1 / 2 \mathrm{lb}$. salt per gallon. H
water until cooled.
Minerals, etc.-Specimens have been re ceived from the following correspondents, and examined, with the results stated
C. H. H-1. It is a ferruginous earth mixed with . We could not undertake to sas just mhat drugs the 2. We could not undertake to say just what drugs the
mixture is composed of,but we can recognize in it flour
ulphur, camphor, mustard,and oil.-J. McF.-1. It is a piece of common red jasper with a few crystals of iron blende.-R. s.-The clay is very impure-it might be or the manufacture of cheap red bricks, but woul ardly pay to attempt purification for pottery. Th ther sample has not come to hand--P. B. O. J.-It is coal shale. The markings observed are those of fossil
ferns of the coal period. These shales are quite too common to be of any commercial value

## NEW BOOKS AND PUBLICATIONS.

A Practical Treatise on the Manufac ture ©F: Starch, Glucose, Starce Sugar, AND Dextrine. By Julius
Frankel. Edited by Robert Hutter 8vo, cloth, pp. 344 . $\$ 3.50$.
This, the only volume on the subject in the English enty the best treau produced in Europe. It is illustrated by half a hundred engravings, including example. of the most recent merican machinery. It describes briefly yet fully the history and chemistry of starch, the differen methods of manufacturing starch from potatoes, wheat rn, rice, and other grains and starch yielding sub acture and uses of starch sugar, dextrine, and allie products; and seems throughout to be well calculated to accomplish its avowed purpose, namely, to advance nd improve a group of industries which have suffered ack of progress inseparable from such modes of pro edure in any industry

Spitzlis Manual and Illustrated Cata
Logue. By Alfred Spitzli. Second
Edition. West Troy, N. Y.: A. \& A.
F. Spitzli. 1881 . $\$ 1$.
The catalogue is a fairly comprehensivel ist of instru ments, accessory apparatus, books, etc., for designer tains nearly two hundred pages of definitions, deriva tions, and explanations of technical terms peculiar to extile manufactures, descriptions of the nature and uses of many substances employed in such manufac tures, processes, rules, tables, etc. The compiler prosimply to present the best authenticated information of value, especially to beginners in textile manufactures. Underground Treasures: How and

Where to Find Them. By James
Baird \& Co. \$1.50. Henry Carey Baird \& Co. $\$ 1.50$.
An's little key for the ready determination Professor Or common useful minerals. Seventy-seven different minerals are plainly described and the principal places of their occurrence in the United States are named. With a set of illustrative specimens it would make a valuable addition to any boy's or farmer's library. By itself it mate of the probable value of any minerals he may discover.
American Nervousness: its Causes and
Consequences. By George M. Beard.
Consequences. By George M. Beard.
New York: G. P. Putnam's Sons. 12mo,
cloth, pp. 352.
In this volume Dr. Beard has presented in the brigh and suggestive style which is characteristic of him the
observations and opinions already familiar to the public through his lectures and contributions to the periodi cal press. Unlike most medical specialists he is dis posed to take a hopeful view of the maladies he has
chosen to study, so far at least as to consider them largely by the natural progress of American society toward more reasonable and wholesome living.
Mensuration and Metrical Geometry An Elementary Treatment of Men-
suration. By George Bruce Halstead. suration. By George Br
Boston: Ginn, Heath \& Co.
So far as can be judged without working through it with a class of students this treatise appears to be ex-
cellently well planned and executed.
Shakespeare's Othello, the Moor of
Venice. By Rev. Henry N. Hudson.
Venice. By Rev. Henry N. Hudson. Boston: Ginn \& Heath. Sq. 16mo, pp. 209. 65 cents.

The twentieth of Mr. Hudson's edition of ShakeThe editor's rank as a Shakespearean critic is wel known. The type and printing are attractive, the paper good, and the size of the volume convenient for holding and carrying.
Elements of Algebra. By G. A. Wentworth, A.M. Boston: Ginn \& Heath. $\$ 1.45$.
We the preparation of this shool book Professor Wentworth has given abundant evidence of a clear appreciation of the needs of the studen
gular skill in the art of book-making.

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Electric light. W. S. Hill, Boston. Mas
Faucets, C, Whittaker, Chicago, Ill
Fire extinguishers, A. Burritt Hardware Company
Gas, manufacture of, F. Egner, Norfolk, Va.
Lighting, W. Wheeler, Massachusetts.
Loom shuttles, J. S. Jaques \& Co., Lowell, Mass Pyroxyline, J. W. Hyatt, Newark, N. J. Penholders and pens, J. G. Hester, Washington, D. C Sewing machines, J. B. Anthony, Providence, R. I.
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