"On zinc, spelter, or tin, manufactured in blocks or pigs, $1\frac{1}{2}$ cent per pound; zinc, spelter, or tin sheets, $2\frac{1}{4}$ cents per pound.

The Cause of the Boiler Explosion at Merrick & Sons.

The unusually intelligent coroner's jury in this case, of which Coleman Sellers was foreman, have rendered a verdict clearly pointing out a fault in the construction of the boiler as the cause of the explosion. It seems also that the order had been given to discontinue the use of the defective boiler, and this order was in course of execution at the time the explosion occurred. We extract the portion of the verdict which explains the faulty construction:—

"The bottom or furnace part of the boiler consists of a series of arched passages used as furnaces; said passages being twenty-one inches wide, semicircular on the top or crown, and stayed from one to the other by a series of iron braces. The parts between the arches are what have been termed water-legs. These water-legs on the old boiler extended from the front to the back of the boiler, thus forming powerful beams, thirty inches in depth, to resist the pressure of the steam tending to push the bottom out of the boiler. At the front they are connected by a water-space below the doors of the furnaces, and at the back by a water-space extending to the bottom; and thus were firmly united and formed, as it were, a floor supported by beams about thirty inches deep, five inches wide, and only thirteen feet long, which were, moreover, tied together, top and bottom, at both ends to prevent their spreading at the bottom from the pressure above; a form admirably adapted to carry the load placed upon it.

"In the new boiler we find that the beams upon which depend the stability of the bottom were not continued from end to end of a uniform depth, but by the cutting-off of the part which was filled with sediment in the old boiler, have been reduced to a depth, from the crown to the bottom, of but thirteen inches for a distance of one-half of their entire length. Hence the floor-beams, as it were, are reduced to less than one-half the depth of those in the old boiler, namely, from thirty inches to thirteen inches in the center of the boiler bottom. The most valuable part of the beams having been removed by this operation, and the main support of the crown sheets taken away, no additional stays were put in to compensate for this weakness.

"Without going into any calculation of the strength of the floor of the boiler, we see that it is not half as strong as the old one, and has yielded under a pressure of only fifty-seven pounds per square inch. That the yield took place at this part, in the very center of the boiler bottom, is manifested by the leak, which persistently appeared at this very part, where a rupture should have begun if the floor was too weak. This leak was mended from time to time, but, on the day of the explosion, had increased to such an extent as to endanger the water-supply, and to cause the order to be given for discontinuing the use of this boiler, unfortunately too late, although this order was promptly given, and was in course of execution."

Kinds of Cotton and the Yield.

The sceptre of King Cotton is wrested from him! The royal prerogative was sacrificed through the reckless passion and insane folly of his friends. Yet it is right: he never was entitled to the distinction. First useful, then influential, then powerful, he became inflated with insufferable vanity, and odious with intolerable arrogance. Profiting by the lesson, reduced to his natural position, he may again become useful, perhaps travel north a little, and act in a circle less circumscribed by prejudice and that "vaulting ambition" that so often overleaps itself.

The plant producing the downy fiber attached to its seeds, which has recently come into use so nearly universal for the various purposes of clothing, is of the same family as the common mallow; botanically considered, of the order *malvaceæ*, of the genus *gossypium*, of which the species, as modified by cultivation, are somewhat uncertain in their classification, the principal being *herbaceum* (the green-seed upland of the Southern States), *hirsutum* (the shrub cotton), and *arboreum* (tree cotton.) The cotton of Peru and South America generally is the *hirsutum*, growing bushy and stout, and living several years in temperate climates destitute of frost. The tree variety is from fifteen to twenty feet in hight, and is found in the East Indies, growing wild, and in South America, the staple long, strong, silky, and yellowish. There is so much variety, in different climates and latitudes, in the size and habit of the plant, the color of the flower and of the seed, the quality of the fiber, and other points of difference, that confusion arises in the classifications of botanists, in different quarters of the globe.

Much the larger proportion of cotton grown is produced in this country. Seven-eighths of the entire product of the world, it has been estimated, has been reached by our increased production. The East Indies occupy the next place, followed by South America (Brazil mainly), the West Indies, and Africa.

It has been used for the manufacture of cloth more than two thousand years, being first known in India, then introduced into Greece and the countries of the Mediterranean. It is now found in all tropical latitudes, and adjacent temperate localities in the United States south of 35°; in the West Indies; in South America down to Peru; in the Pacific Isles; in Australia, Japan, India, and China, and in nearly all explored portions of Africa.

The United States census for 1850 gave the average product per acre in unginned cotton, by States, as follows:—

Florida	250	pounds.
Tennessee	300	"
South Carolina	320	"
Georgia	500	"
Alabama	525	"
Louisiana	550	"
Mississippi	650	"
Arkansas	700	"
Texas	750	"

This statement shows the difference in soil, and the effects of wasteful culture in the older States; but it shows most conspicuously, also, the influence of climate, especially in the figures for South Carolina and Tennessee.—*Report of Agricultural Department.*

BARON VON LENK'S GUN-COTTON PATENTED IN THIS COUNTRY.

On the 4th of June, 1864, Baron Von Lenk procured a patent through the Scientific American Patent Agency, for the manufacture of gun-cotton by his process in the United States. The assignees of the patent in this country are Messrs. Rawson & Richmond, of Detroit, Mich., who announce their purpose to proceed at once to erect a large manufactory, and to embark in the production of the article. Their establishment will be under the charge of a practical and competent person sent over from Austria by General Von Lenk.

Our readers will remember that the commission of Austrian chemists came to the conclusion that "gun-cotton is far superior to gunpowder for all explosive power; that its use is less dangerous; that for artillery and small-arms one pound of gun-cotton will give greater result than three pounds of gunpowder, and for blasting and mining purposes 1 lb. of the former is equal to 6 lbs. of the latter; that damp does not affect it; that it is not liable to decomposition; that it will not explode short of 277° Fah.; that there is no smoke; that there is no fouling or refuse matter; that the recoil of the gun is but $\frac{2}{3}$ of that from gun-powder; that lighter and shorter guns can be used; that the velocity of the projectile is greater and more accurate; that the heating of the gun is much less; and that there is no danger in its manufacture."

The statement that the velocity imparted to the shot is greater while the recoil of the gun is less, we should hardly believe except on further evidence than the report of one commission, however eminent.

In consequence of the general interest in this improvement we publish the patent in full. It contains a complete description of the process in as few words as possible.

IMPROVED GUN-COTTON.

To all whom it may concern:—

Be it known that I, Baron W. Lenk, of the city of Vienna, in the Empire of Austria, have invented a new and improved mode of making an explosive material out of cotton and other vegetable fibers; and that I do hereby declare that the following statement is a full and accurate description of the articles used, and the mode and manner of manufacturing the same, into an article which is termed, "Baron Lenk's Improved Gun-cotton."

First, The cotton or other vegetable fiber is first taken and spun into loose threads of sufficient strength to be easily handled.

Second, The cotton must then be thoroughly boiled in a solution of potash or of soda, in order to remove all greasy substances which the cotton may contain, and after thus boiled it may be exposed to the sun, or wind or in a heated room, to dry the same.

Third, The cotton must now be taken into a room heated to 100° Fah. in order to make it perfectly dry.

Fourth, A mixture is now made containing one part weight of nitric acid of $1\frac{48}{100}$ to $1\frac{50}{100}$ specific gravity, and three parts weight of common sulphuric acid. This mixture must stand in closed earthen or glass jars for several days, or until the two acids become fully mixed and cooled.

Fifth, This mixture of acids is now put into an apparatus containing three apartments, one for the main bulk of the acids, one for the immersion of the cotton, and one for receiving the cotton after being immersed. This apparatus may be made of cast-iron.

Sixth, The cotton is now taken and dipped in the acid bath, in said apparatus, in such a manner that every three ounces of the cotton must come in contact with sixty pounds of the mixture of acids, or in other words, the bath must contain fully sixty pounds of the mixture while parcels of three ounces of cotton are being dipped. The parcels thus dipped must be gently pressed, and the acids allowed to flow back into the acid bath, and the parcels are then put into the third apartment of the apparatus, where for every one pound of cotton there must be ten and a half pounds of said mixture of the acids. The cotton must remain in this state subject to the action of the acids for forty-eight hours, and the mixture must always have an equally strong concentration, and must be kept under a uniform temperature by a cooling process.

Seventh, The cotton is now taken out from the acids and pressed, and then put into a centrifugal machine to remove all surplus acids.

Eighth, The cotton is again put into another centrifugal machine, into which a constant stream of fresh water is admitted. This process is intended to remove the last particles of adhesive acids.

Ninth, The cotton is now taken and put into a flume or trough, and secured in such a manner that a running stream of fresh water may pass through and over it; and the same must remain in this situation for at least fourteen days. To lessen the time for this operation the cotton may be immersed or saturated in alcohol for the space of twenty-four hours. This process is also intended to extract all and the last particles of acids that may possibly adhere to the cotton.

Tenth, The cotton is now taken from the stream of water, or if from the alcohol it must be washed, and then boiled in a solution of common soap and again dried. This process is intended to restore the cotton to its original softness and appearance.

Eleventh, The cotton is now taken and immersed in a solution of water-glass of one pound to two pounds of soft water which must be $1\frac{09}{100}$ specific gravity of concentration. To one pound of cotton $\frac{198}{1000}$th of a pound of this solution of 46° Beaumè is required. The cotton is then taken out of this solution and exposed to the action of the atmosphere for at least four days. This process has the tendency to preserve the material, and also to make its explosive qualities less rapid.

Twelfth, The gun-cotton is again washed in soft water free of lime, dried, and can then be packed in wood or metal boxes for storage or exportation; and may be used for artillery. Torpedoes, shells, mining blasting, small-arms, and for all purposes where explosive power is required.

Thirteenth, All other vegetable fibers may be treated and manufactured as herein stated, which process will make the same explosive like the gun-cotton and adapted to the same purposes.

I claim as my invention an explosive improved gun-cotton made substantially as herein described,

BARON W. LENK.

City of Vienna, Austria, Dec. 1, 1862.

AN American pint holds 7,000 grains of water.

The Concentration of Power.

As the power of steam is the most universally applicable of all the forces used for driving machinery, its concentration becomes a matter invested with considerable importance. A great deal has been done in the production of small high-speed engines of late years, but a great deal more remains to be done before the principle can be regarded as approaching those limits, beyond which it may be neither safe nor prudent to carry it. The *Great Britain* locomotive has frequently given out 1,000 horse-power for many minutes together, with a pair of 18-inch cylinders, 24-inch stroke, the weight of the engine in working order being little over 35 tuns, or, with the tender, 50 tuns. This may, perhaps, be considered as a maximum effort which it would not be advisable to attempt to maintain. Taking the work done, then, at but half this, or 500 horse-power, we have still over 14 horse-power per tun; or, if we neglect the weight of the wheels as in no way necessary to the development of this power, we have at least 15 horse-power per tun of machinery. One of the steam fire-engines, tried last year at Sydenham, developed nearly 30 horse-power, the weight being under 50 cwt. This estimate of power does not pretend to strict accuracy, as the indicator was not used, and the power was calculated merely at an assumed pressure, some 20 or 30 lbs. less than that in the boiler. Still if we disregard the weight of the wheels, driving seats, etc., we find that the amount of power developed nearly equals that of a first-class locomotive, weight for weight. Modern express engines give out 350 horse-power as a matter of daily occurrence, and even goods' engines sometimes a great deal more. It is needless to say that in all these cases the power is obtained by an extremely high velocity of piston. In stationary engines, seldom confined in space, the march of improvement goes slowly, but, nevertheless, steadily on; and we trust ere long to see the clumsy beam and its appendages banished forever in favor of high speed engines, working expansively. The *Allen* engine, exhibited in 1862, inaugurated a change of practice, which is slowly making its way. This engine had a piston speed of 600 feet per minute, and ran 140 revolutions with an ease, steadiness, and absence of heating, not greater, perhaps, than was to be expected from the care taken in designing the machine to the minutest details, but very satisfactory, nevertheless, in that it furnished a complete refutation to arguments now and then brought forward, and dug up, as it were, from old-fashioned practice, to prove that a high speed engine must in the nature of things be a failure.

[There is a beam engine, 16-inch cylinder and 4 feet stroke of piston, of the Corliss pattern in Providence, R. I., which makes, day and night, 650 feet piston-speed per minute.—Eds.]

In order then, to concentrate power, it is only necessary to impart a high velocity to some member of a system of mechanism which first receives the direct effect of the original moving force, as the piston of a steam engine, or the bucket vanes of a turbine. No theoretical objections exist to the adoption of this course. The practical objections are found to reside chiefly in friction, and the difficulties met with in carrying out a complete and thorough system of lubrication. In the case of vertical spindles heavily loaded, and running at high velocities, it is necessary that the footstep should be worked to some curve, which will extend the bearing surface and prevent the extrusion of the lubricant. In the case of steam engines, the main-shaft bearing seldom gives trouble if properly made, especially if the weight of the fly-wheel is sufficient to keep the shaft down steadily in the lower brasses. The connecting rod head, with its brasses and crank-pin, are not so easily dealt with, and it cannot be denied that the annoyance which those occasion, has done much to retard the introduction of high-speed engines. The fact is, that the brasses will not permit of that amount of looseness or play which may exist in any other bearings almost, because of the destructive hammering action which ensues. It is not easy to say why tightening a brass should make it heat; we find in every-day practice that a bearing which supports perhaps 1 cwt. per square inch, without undue friction so long as it is left moderately slack, will become almost red hot in a few minutes, if an additional pressure of not more than a few pounds per square inch is brought on it by screwing down the cap. Until we can give a satisfactory explanation of this phenomenon, it is not easy to see how its occurrence can be guarded against. Meanwhile, it is the source of all the trouble ever met with from a connecting rod end. The best remedy appears to consist in increasing the surface very considerably, and providing an effectual method of lubrication, either by a telescope pipe from an overhead vessel of oil, or, in cases where the engine stands for a few hours out of the twenty-four, by boring a large cavity in the crank-pin, and filling it with tallow, a transverse aperture conveying the lubricant when melted to the surfaces where its presence is required. Attention to little matters of detail and good workmanship are really all that are required to insure the success of any motor running at a high speed.—*London Mechanics' Magazine.*

PETROLEUM FOR GENERATING STEAM.

We have received from R. A. Fisher, M.D., an analytical and consulting chemist of New Haven, Conn., a pamphlet giving an account of some experiments undertaken by him to ascertain the value of petroleum burned by Mr. Hill's method as compared with anthracite coal for generating steam. By Hill's process the petroleum is evaporated in a close box, steam is mixed with the vapor, and the vapor is burned as it issues from bat-wing burners.

Dr. Fisher burned petroleum by this plan "several hours" under a small boiler and measured the water evaporated. He then burned anthracite coal under the same boiler for four hours and thirty-five minutes, and measured in this case also the water evaporated. The steam was generated under a pressure of forty lbs. to the square inch, and hence from a temperature of 268°. After making proper allowances for the heating of the water the results were 7·81 lbs. of water, at 268°, converted into steam by 1 lb. of petroleum; 4·89 lbs. of water at 268°, converted into steam by 1 lb. of coal; or, 2,000 lbs. of coal gave the same heating power as 1,252·2 lbs. of petroleum.

"With coal at ten dollars ($10) per 2,000 lbs., it would appear from these figures, that petroleum of the quality used in the experiments just described, in order to compete with coal, must be furnished at ten dollars for 1,252·2 lbs. (198·69 gallons), or at 5·02 cents per gallon. But if burned in the apparatus of Mr. G. Hill, it must be furnished at a still lower figure; for while with coal the whole amount of steam generated can be used to drive machinery, in Mr. Hill's apparatus, a large proportion of the steam produced is required to assist the combustion of the petroleum.

"No experiments were made to determine exactly the quantity of steam thus employed, but from the fact that the coal evaporated but about four gallons of water per hour, while the petroleum evaporated about six gallons, without causing more steam to pass through the 'safety valve,' we must infer that the steam produced from two gallons of the water per hour (or about one-third of the whole amount generated), passed through the 'steam feeding pipe' into the retort, and thence to the burners.

"In view of all the facts elicited by these experiments, we cannot avoid the conclusion that at the present prices of petroleum and coal, say coal at $10 per 2,000 lbs., and petroleum at 40 cents per gallon, the cost of fuel in Mr. G. Hill's process, of burning the vapor of petroleum in contact with 'superheated steam,' is about ten times as great as when generating steam with coal."

Dr. Fisher concludes his pamphlet in these words: —"According to Mr. Tate, 'the oils (petroleum) as found in nature, contain as nearly as possible an equal number of equivalents of carbon and hydrogen.' This would make the composition of crude petroleum nearly identical with oil of turpentine. MM. Favre and Silbermann, in their refined researches already quoted, found the heat evolved by the perfect combustion of 1 lb. of turpentine to be sufficient to raise only 108·52 lbs. of water from 31°—212°. This, then, is about the maximum calorific power of crude petroleum—11·64 per cent greater than that of anthracite coal. Therefore, whether the perfect combustion of crude petroleum be effected by burning it directly, or after having converted it into gas; whether it be burned in the state of vapor alone, or mixed with air, or 'superheated steam' (as in Mr. Hill's apparatus), or though the mechanical arrangement consists of 'a series of corrugated recesses upon a vertical cone of cast-iron placed in the furnace' (as contrived by Messrs. Shaw & Linton), it is impossible to develope a greater calorific power than that with which it has been endowed by nature—that of heating about 108 times its weight of water from 32°—212°: a calorific power not quite 12 per cent greater than that of anthracite coal.

"It is therefore fallacious to suppose that at the present relative prices of coal and petroleum, this substance, by any 'improved method of burning,' can be made to generate steam as cheaply as coal. Of the truth of this, science has already convinced those who have faith in her teachings; accurate experiment will, in due time, convince those who are satisfied only with tangible evidence."

NEW BOOKS AND PUBLICATIONS.

The Indicator and Dynamometer. Main & Brown. Henry Carey Baird, Publisher, 406 Walnut street, Philadelphia.

The intelligent engineer who aspires to become something more than a mere "stopper and starter" takes every opportunity to increase his stock of theoretical knowledge. For without a union of both practice and theory but little substantial progress can be made. In looking at a steam engine in operation we see nothing but the outward movement. It may turn its centers smoothly and without jar, and be apparently in excellent order; but when we ascertain what is transpiring within the cylinder, by means of the indicator, it may be found that twice the amount of fuel is consumed to do the work that is necessary.

It is for the purpose of ascertaining whether an engine is doing what it should that the indicator is provided, and no establishment that burns fifty tuns of coal in a year should be without one. Engineers should make themselves familiar with the instrument, and extend its use as much as possible; much greater economy in the use of steam would be the result.

The treatise which we have made the caption of this notice is a standard work, and is clear and lucid to those who study for information and not curiosity. It is illustrated with diagrams showing defects in engines, pointing out the cause and cure, and explaining the principle on which the indicator works, so that the student not only knows that the diagram is made in such and such a manner, but also *why* it is so made.

Every engineer in the country, not acquainted with the indicator, should send for this work and master it, and manufacturers should encourage their engineers to do so, for a thorough knowledge of the instrument will result in economy to them if it is practically applied. An advertisement can be found in No. I., Vol. XI., Scientific American.

Phrenological Journal. Fowler & Wells, 389 Broadway, New York. $2 per annum, in advance.

The July number of this periodical commences the fortieth volume. A very marked improvement is visible in this number, both in appearance and character of the contents. The magazine, for such it now is, contains a great many handsome illustrations of military men and others in civil life, with dissertations on their characters, as shown by their crania. The general reader will find much to interest and instruct him.

Patent Breech-loading Tobacco Pipe.

In the list of English patents published in the London *Mechanics' Magazine* of May 20th, is this:—

2,424.—An improved mode or method of filling tobacco pipes of an improved construction.—G. R. Tilling and J. Park. Dated October 3, 1863.

In carrying out this invention the inventors fill or charge the bowl, head, or other tobacco-containing part of a pipe with tobacco from the bottom, the side, or the rear of such bowl, head, or other tobacco-containing part, in manner which will be wel understood as breech-loading. And to permit of such filling or charging, they construct pipes with apertures at the bottom, the side, or rear of the bowls heads, or other tobacco-containing parts, sufficiently large to allow a charge or "fill" to be passed in either under tobacco already lit in the pipe, or for filling before lighting, and such apertures they close by any suitable means.