rate per thousand at which he will allow the Government to make them. These proposals will be made separately on forms to be furnished on application, and will be directed, sealed, to the Recorder of the Board, and endorsed "Proposals for furnishing Breech-loading Arms," and will be opened at such time as the Board may direct.

After the hundred rounds fired by the inventor, the gun is taken by the Board, and without being cleaned, is fired first to test its strength. The powder used is fine-grained rifle powder. The gun is fired first with 65 grains of powder and 2 bullets, then with 70 grains of powder and 3 bullets, then with 75 grains of powder and 4 bullets.

It is then fired for accuracy at 200, 500, and 1,000 yards. In firing for accuracy the arm is secured in a clamp which has a sliding motion on ways to permit the recoil. The test for penetration is made by firing through a number of white-pine boards placed an inch apart, and each an inch in thickness; they are placed at a distance of thirty yards from the gun.

Among the inventors who were present to explain their guns to the Board were Governor Jackson, of Rhode Island, formerly of the Burnside Rifle Company, Dr. Maynard, of New York, and other gentlemen who had made the rifle, and especially breech-loading rifles, the subject of long study and experiment. The only objection made by these men to the trials was the extreme severity of the test for strength to which the guns are subjected. Governor Jackson said that the test of firing with four bullets was first adopted in examining the old muzzle-loading musket, on the ground that the soldier, in the confusion of battle, was liable to load his gun three or four times without firing it; but as it is impossible to get more than one charge into a breech-loader, he did not see the necessity of so severe a test for this style of arm. The reason assigned by the Board for this test is that cavalry carry their carbines with the muzzle down, and it is liable to become filled with mud. In reply to this, Governor Jackson says that if the muzzle is closed with mud, the barrel will burst, whatever the strength of the breech; he has tried the experiment of closing the muzzle with a cork, and the gun always bursts at the muzzle.

The inventors present seemed all to agree that no good shooting could be done by fastening the gun in a clamp; the proper way being to have a good double rest, and fire from the shoulder. I also put in the suggestion that for firing with any accuracy 1000 yards, a telescope is essential. No man can tell at this distance, by looking with the naked eye through the open sights of a rifle, whether the piece is, or is not, pointing at a barn door. In a trial for skill among rival riflemen, I approve of firing off-hand and with open sights, but in testing the gun, all errors of aim should be eliminated if possible.

When among men familiar with the subject, I always raise the question of the comparative accuracy of breech, and muzzle loaders. I found the men here all to agree that a good breech-loader is even more accurate than the American target rifle. Dr. Maynard said that Cyrus Bradley, of Otsego Co., N. Y., was ready at any time to bet that with his breech-loader he could beat any muzzle-loader, the barrel of which was not heavier than his entire gun. For this accuracy Dr. Maynard insists on the condition that the cartridge shall be of the right material, and shall be properly designed and made. Then, he contends, the axis of the bullet may be made to coincide more exactly and more surely with the axis of the barrel, than by swedging through Clark's false muzzle. I am now pretty well satisfied, though not fully, of the correctness of this position, and if it is sound, there can be no doubt that breech-loading rifles will rapidly supersede muzzle-loaders for sporting purposes, whatever may be the decision in regard to the army. A serious drawback from the pleasure of rifle shooting is the great amount of greasy and filthy labor in cleaning and loading the gun after every discharge. This is nearly all avoided in the breech-loader, and will be entirely avoided when inventors succeed in producing a cartridge that will effectually clean the gun at every fire.

G. B.

## WEIGHTS AND MEASURES.

### THE METRIC SYSTEM AND ITS EQUIVALENTS.

The bill passed by the House of Representatives to authorize the use of the metric system of weights and measures—now pending in the Senate—provides that the following tables shall be recognized in contracts and legal proceedings as the equivalents of the weights and measures of the metric system: Any apparent complexity of the system will disappear when it is observed that it depends upon a single unit—the meter—and that any denomination of measure can be expressed in meters, square meters or solid meters. The gram is the weight of a cube of water a hundreth of a meter on each side. For ordinary uses the words meter and gram are the only new words to be learned.

It should also be noticed that although the weights and measures are in value precisely the same as those used in Europe, the names have been so changed as to accord with the spirit of our language.

MEASURES OF LENGTH.

| Metric Denominations and Values. | Equivalents in Denominations in Use. |
|---|---|
| Myriameter ..... 10,000 meters. | 6·2137 miles. |
| Kilometer ..... 1,000 meters. | 0·62137 miles, or 3,280 feet and 10 inches. |
| Hectometer ..... 100 meters. | 328 feet and 1 inch. |
| Dekameter ..... 10 meters. | 393·7 inches. |
| Meter ..... 1 meter. | 39·37 inches. |
| Decimeter ..... 1-10 of a meter. | 3·937 inches. |
| Centimeter ..... 1-100 of a meter. | 0·3937 inches. |
| Millimeter ..... 1-1000 of a meter. | 0·0394 inches. |

MEASURES OF SURFACE.

| Metric Denominations and Values. | Equivalents in Denominations in Use. |
|---|---|
| Hectare ..... 10,000 square meters | 2·471 acres. |
| Are ..... 100 square meters | 119·6 square yards. |
| Centare ..... 1 square meter | 1,550 square inches. |

METRIC DENOMINATIONS AND VALUES.

EQUIVALENTS IN DENOMINATIONS IN USE.

MEASURES OF CAPACITY.

| Names. | Number of Liters | Cubic Measure. | Dry Measure. | Liquid or Wine Measure. |
|---|---|---|---|---|
| Kiloliter, or stere | 1,000 | 1 cubic meter | 1·308 cubic yards. | 264·17 gallons. |
| Hectoliter | 100 | 1-10 of a cubic meter | 2 bushels and 3·35 pecks. | 26·417 gallons. |
| Dekaliter | 10 | 10 cubic decimeters | 9·08 quarts | 2·6417 gallons. |
| Liter | 1 | 1 cubic decimeter | 0·908 quarts | 1·0567 quarts. |
| Deciliter | 1-10 | 1-10 of a cubic decimeter | 6·1022 cubic inches. | 0·845 gills. |
| Centiliter | 1-100 | 10 cubic centimeters | 0·6102 cubic inches | 0·338 fluid ounces. |
| Milliliter | 1-1000 | 1 cubic centimeter | 0·061 cubic inches | 0·27 fluid drams. |

WEIGHTS.

| Names. | Number of Grams. | Weight of what quantity of water at maximum density. | Avoirdupois weight. |
|---|---|---|---|
| Millier, or Tonneau | 1,000,000 | 1 cubic meter | 2,204·6 pounds. |
| Quintal | 100,000 | 1 hectoliter | 220·46 pounds. |
| Myriagram | 10,000 | 10 liters | 22·046 pounds. |
| Kilogram or kilo | 1,000 | 1 liter | 2·2046 pounds. |
| Hectogram | 100 | 1 deciliter | 3·5274 ounces. |
| Dekagram | 10 | 10 cubic centimeters | 0·3527 ounces. |
| Gram | 1 | 1 cubic centimeter | 15·432 grains. |
| Decigram | 1-10 | 1-10 of a cubic centimeter | 1·5432 grains. |
| Centigram | 1-100 | 10 cubic millimeters | 0·1543 grains. |
| Milligram | 1-1000 | 1 cubic millimeter | 0·0154 grains. |

It is intended to start the *Great Eastern* on her second attempt to lay the Atlantic cable July 1st.

## EDUCATION OF WORKINGMEN.

The grand movement now on foot, confined to no particular section of the country, for the reduction of the hours of labor, urges, among the best reasons for its success, that of giving the workingman more opportunities for mental culture. Without arguing either for or against the claim that the two hours thus proposed to be taken from each day's labor will be employed, even partially, in study, there is an obvious need for a better mental and theoretical education among our workingmen, especially mechanics. Those departments of industry are the best paid and highest valued into which enters most of the intellect—the brain labor.

The expertness necessary to guide the machinist's drill, turning chisel, or planing tool, to use the file or the cold chisel, or to wield the blacksmith's hammer, necessitates only a certain amount of practice; but above this animated machine, working under another's will, there is a position where guiding, and managing, and controlling brain exerts its wonderful power. Still further we may look and see the scientific mechanic and the inventor, one the trusted and trustworthy means of achieving works which are destined to benefit coming generations, and the other a genius who, more than diplomats or statesmen, guides and controls the destinies of nations. These grades between the laborer and the thinker are necessary and will always exist. Machinery, well called "labor-saving," will more and more infringe upon the province of the muscle user, although it may never entirely dispense with his services. It cannot, however, more than trench upon the boundaries which defend the brain user; his position is one of comparative security.

Arguing from these premises, what ought to be the object of our delvers, our laborers, our musclemen? Evidently to qualify themselves to ascend another step on the ladder of improvement. Education of the reasoning faculties is the only means to that step; not book knowledge merely, but that alertness and discipline of the mental powers which is stimulated by study and maintained and strengthened by observation and practice.

Take a familiar example of the advantage of a knowledge of principles and the proper application of them to practice. A workman in a machine shop is required to cut on a shaft a thread of perhaps eight to the inch; the chart attached to all modern screw-cutting lathes gives him the gears for the spindle and the leading screw. The result is the required thread. But why? Somebody, he who planned the lathe, knew; why not he who uses it? How easy to know! The rules of arithmetic which enables the workman to calculate his wages by the day, the week, the hour; applied to this matter, would explain all. Suppose the leading screw which guides the cutter to be of a pitch of two to the inch; if it revolves at the same rate as the shaft to be threaded, the result will be a duplicate of the leading screw. But he desires to make four threads on the shaft to each thread on the screw. It is evident, therefore, that the latter should revolve only once, while the former rotates four times. Now the way is clear. If he places upon the spindle a gear of forty teeth that on the screw must contain just four times as many, or one hundred and sixty. So with any gear first selected, the proportions must be as four to one.

Simple as is this philosophy of relative motions, thus familiarly illustrated, it is well known that many machinists have never given it a thought. And it is a shame to some mechanics that they do not care to know "the reason why," but are content to worry through their week's work and receive their week's wages without having gained one iota of additional knowledge, beyond the mechanical expertness inseparable from constant practice. No appeal to professional pride or personal ambition can be of value to such men.

To the ambitious workingmen, of whatever branch of industry, we appeal to use their opportunities. A single half hour out of the twenty-four, devoted earnestly to the study of some department of knowledge applicable to their particular business, will result in one short year—if the mind is active to make application of the knowledge by observation and experience—in an improvement which will astonish them. They will notice it in an increasing interest in their work; what was before a distasteful drudg-

ery becoming a pleasant employment. They will see it in an increased appreciation of their services by an intelligent employer; for nothing is more annoying to an employer, manager, or foreman, than to be compelled to watch every movement of his workmen, from the fear that the job may be retarded, injured, or ruined. They will feel it in the growing consciousness of increasing independence, in the certainty of employment in dull times, in the opportunities for advancement, and in their fitness for higher and better positions.

## MONITORS IN ENGLAND.

Our English exchanges continue to discuss the monitor question at great length. The *Engineering*, Mr. Colburn's new paper, and the *Engineer*, treat the matter by correspondence, by the burin of the engraver, and by leaders. Mr. John Bourne, whom all the engineering world is well acquainted with through his works, openly advocates them, and argues in their favor, condemning in strong terms those antique ships with top lofty sides and thin armor which constitute the naval force of European nations.

It must not be inferred that monitors meet with favor on all sides. Quite the reverse. The *Engineer* declares that "such ships as the *Dictator* are unseaworthy and objectionable as cruisers in every respect. Even Americans admit the fact. We must, in short, have free board. Of what should it consist? Of vessels of moderate size, apparently of thin, tough plates of the best possible iron, say three-fourths of an inch to seven-eighths of an inch from the upper edge of the armor plating up say twelve or fourteen feet;" and the editor goes on to say that this thickness of metal would not offer sufficient resistance to explode a fuseless shell, and that splinters dislodged by bullets and round shot would not do much damage to the crew if mantlets of rope or hide were suspended in-board. The *Engineer* also says it would appear that on the whole ships with unarmored upper works are safer than those with imperfect armor—a laborious conclusiou to arrive at in a leading article of a column and a-half.

"Three wise men of Gotham went to sea in a bowl; if the bowl had been stronger this song would have been longer", and that is the predicament of our British friends. Two horns of a dilemma are presented, but they are both sharp and unpleasant: Either they must abandon the monstrous ironclads they have constructed at such immense outlay, and build others on approved plans, such as the monitors, or lose their boasted supremacy on the sea in case of a naval war.

On the whole, it is inferred by the journal which claims to lead in matters of this kiud, that armored ships are of uo particular utility when they are fourteen or fifteen feet out of water. No one familiar with the performances of our vessels would dispute this statement. We are quite well satisfied with the performance of our ironclad fleet, and the comments of the English press strengthens ourconfidence.

## SALT AND SODA.

The *Tribune* of the 29th ult. records the fact that within the last ten days soda ash has gone up half a cent a pound, and laments that "there is not a single living, kicking, soda-ash factory iu all our country." Although the *Tribune* is slightly mistaken about the existence of soda-ash factories in the United States; yet its complaint that we are dependent upon foreign countries for soda ash is well founded. The American soda ash is manufactured only incidentally or accidentally, and is so small in quantity that it does not affect the price or the consumption of the article. It is made here simply to use up materials about acid factories which otherwise might be wasted.

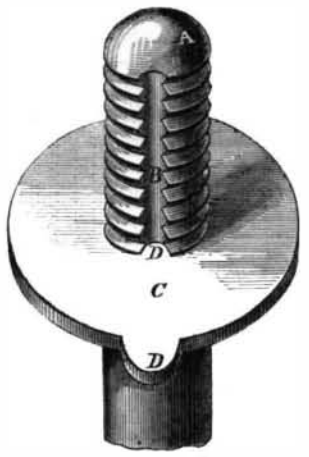
The present obstacle to the manufacture of soda here is the want of cheap salt; in this country salt costs eight or ten times more than in England. The other raw materials needed, sulphur, coal, and manganese, we have in great abundance, in fact, we are more favored than any other country. But there is plenty of salt in the sea, and we have plenty of places like the Jersey flats which might be used for its extraction.

Some of our readers may ask "what of it?" and "what is soda ash to us?" The soda ash manufacture implies more extensive manufacturing establishments than now exist on the continent. It does not concern soda ash alone, for about it clusters, as of necessity, the manufacture, at the same time, of acids, bleaching powder, and hyposulphite of soda.

Some of our most important arts are built on soda ash. Without it, no soap, no glass, no white paper. If the supply of soda ash should be interrupted for six months, what would become of us? As we have suggested above, our salvation, would be salt. The American people cannot do any thing more profitable than to find us salt for ten cents a bushel.

## HICKMAN'S IMPROVED WASHER.

The annexed engraving represents a bolt with a longitudinal slit, and a washer with two lips, one of which enters the slit in the bolt and prevents the revolution of the washer, the other being bent up against




the nut to prevent the latter from becoming loosened. The object is to prevent the loosening or loss of nuts or burrs where exposed to jar or tremulous motion, and in many places will answer a very desirable purpose. Patented May 29, 1866, through the Scientific American Patent Agency, by G. G. Hickman, Coatesville, Pa., to whom address for further information.

## How American Velvet is Made.

The machinery for the manufacture of American velvet was introduced into this country by the inventor, a Mr. Holt, of Cheshire, England, and its superiority in the matter of rapidity is said to be as great as that of the modern railroads over the old stage coach system. The method is as follows:—Grooved brass rods or wires were placed under the web which forms the pile, secured by threads woven into the warp. The weaver cuts the threads by means of a knife, held in the hand, the blade of which slides along the groove, dividing the pile into two rows of threads, thus giving a nap or pile of the depth of the rod inserted.

The manufacture, according to the patented method, is accomplished by weaving two warps or foundations, with a middle warp alternately rising into the upper and lower, being secured by two shuttles moving at once. The knife moves horizontally, in the same direction as the shuttles, and the two warps and the pile between are divided, and the naps are cut into equal lengths. Two plied fabrics—the exact counterpart of each other—are thus made at one time. The shuttles and knives are all impelled by the ordinary motions of the power loom.

The statement that 110 picks or threads are made in a minute (or nearly two every second) will give some idea of the rapidity of the manufacture. A man with a patented machine can make from fifty to sixty yards per week, while eight or ten yards would be a good week's work for the same person should he make use of the ordinary hand-loom. The saving of labor by this process over the wire-weaving method is estimated at from fifty to seventy per cent., while the fabrics are equal, and, in some respects, superior to those of foreign make. The looms are adapted to the manufacture of plied fabrics, such as silk plush, since an article of this nature for gentlemen's caps has become very popular as a substitute for fur. Tartan, or clan velvets, are also made.—*Commercial Bulletin.*

Stamp Your Receipts.—The importance of stamping receipts was recently determined in this city in a suit against a party who neglected to attach the required two-cent revenue stamp to seven receipts. The fine for such neglect is $200 for each and every offence, and the party sued was fined $1400. The example is worthy of remembrance.

## An Extensive Salt Mine.

The New Orleans *Times* gives an extended account of what it considered the purest and most important natural deposit of salt in the world, located on the coast of Louisiana at Petit Anse Island. The deposit was known as early as 1698-99, out all knowledge of it appears to have been lost until after the commencement of the recent war. During that period, when the supply from other sources was cut off, the mine was discovered by residents of the interior who had resorted to the island for the purpose of procuring salt by boiling, and for two years nearly the whole of the trans-Mississippi region was supplied from that source, no less than two thousand pounds having been taken from it in three months. When the island passed into the hands of the Federal forces, the works, buildings, etc., were destroyed, but it has recently been purchased by New York capitalists, who, in developing the property, have found the salt rock from thirteen to twenty-two feet below the surface, extending over a great number of acres. Pits of over forty feet in depth have been sunk through the salt without finding any indications of reaching bottom. The salt formation is almost perfectly pure, chemical analysis showing that it contains about ninety per cent pure salt. The development of the property is being rapidly pushed, and the product has already reached two hundred thousand pounds per week, with a force of ten hands. This mine is regarded as forming a prominent part of the material resources of Louisiana.

## Estimates about the Cotton Crop.

A good deal of interest is manifested in the probable amount of the cotton crop for 1866. Some writers have estimated it as high as 2,500,000 bales, but a correspondent of the Vicksburg *Journal*, who has recently visited several counties in different sections of the State, estimates the cotton crop at a fraction less than 1,500,000 bales.

A letter from Georgia, recently published, says:—

"The cotton crop of 1860 was 5,000,000 bales, which brought into the Southern States $175,000,000. South-west Georgia produced 110,000, receiving $3,500,000. The crop of the current year will range somewhere about 1,200,000, and south-west Georgia will yield at least 90,000 bales; hence, if cotton commands 25 cents per pound next fall, this favored section will obtain nearly $12,000,000, and consequently will be, by long odds, the richest district south of the Potomac. This country suffered comparatively nothing from the war; no enemy penetrated into this portion of the State; labor was uninterrupted; property was not destroyed or wasted, and a greater quantity of first-class land is now in cultivation than in 1860; and lastly, the planters are turning their attention exclusively to the production of cotton.

"In the present disordered state of Southern society, it is almost impossible to collect sufficient reliable data to ground an estimate upon, and I freely confess I am not able, by reasoning, to maintain the figures made elsewhere; but this we do know, an immense tract of our cotton-growing region is now idle, and that numbers of what were formerly most productive plantations, are now being worked with one-half of the customary force. Some of the papers say that the crops will be diminished one-third from this cause alone. Then there are three other causes operating in this direction—the scarcity of mules and horses; the scarcity of cotton seed; and the scarcity of labor."

How to Cure a Felon.—As we often see friends suffer with these very troublesome things, we publish the following cure for them, which we have heard highly recommended:—As soon as the parts begin to swell get the tincture of lobelia, and wrap the part affected with cloth saturated thoroughly with the tincture, and the felon is dead. An old physician says he has known it to cure in scores of cases, and it never fails if applied in season.—*Journal of Medicine.*

Prize for an Invention.—The French Government has issued a decree, published in the *Moniteur*, by which a prize of 50,000 francs, or $10,000, is to be awarded, within the next five years, to the person who shall discover a system by which the voltaic battery can be economically applied to heating or lighting purposes.