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.

EQUIVALENTS IN DENOMINATIONS IN USE.

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-