registering apparatus for recording and exhibiting the amouut and the quality of the products of the still. The abuse of the power possessed by inspectors and the dishonesty of some manufacturers have been carried to such an extent that large amounts of whisky have been offered for sale at a less price per gallon than the government tax of two dollars. For this state of things a remedy was imperatively demanded. We think the demand has been met.

The Secretary of the Treasury appointed Professors Henry and Hillyard, of the National Academy of Science to investigate devices intended to register the quantity and quality of the spirits distilled, and they reported in favor of an invention by Mr. Isaac P. Tice, of New York city. Consequently, Mr. Tice's apparatus, several patents in which were secured through this office, has been ordered to be attached to all stills in the country. Next month (May), every distiller must give notice of his desire for one of the meters and deposit the money for the same, as a condition of his continuing his business. An order will probably soon be issued that these meters shall be attached by November next, and Mr. Tice has made arrangements for supplying the demand, however great it may be.

The points contemplated by the introduction of this device are the following:

1. An automatical registration of all the liquid, whether high or low wine, which passes from the still.
2. A similar record of the strength of the spirits from time to time as they are produced.
3. An arrangement by which the distiller may be allowed, at will, to take the necessary proofs of the spirits as they come from the still, and separate the low from the high wines, without being able to interfere with the automatic registration.
4. The inclosure of the measuring apparatus in a safe, which shall prevent interference with its interior and cannot be broken into with bearing evidence of burglary on subsequent inspection.
5. The isolation of the doubler and condenser, so that no liquid may be abstracted from them by concealed tubes or other means.
6. An arrangement by which assurance is given that all the low wines which pass from the worm are returned to the doubler.
7. Such regulations as will insure successive and independent inspections by different persons at irregular times.

The *modus operandi* of the registration process is simple, and the proposed methods of inspection are as follows:

1. The distiller must report at intervals, as provided by law, the amount and strength of the product of each day.
2. The samples taken by the meters are of two kinds, which may be designated as the long and short samples. The short sample, which indicates the strength of the liquid from day to day, and is intended to check the report of the distiller, must be drawn and inspected each day by an officer detailed for that purpose.
3. The samples to be examined three times in a month, or at irregular periods, by another officer especially detailed for that duty, and the results to be compared at the office of the Assessor, with the average results of the previous inspections, each officer reporting at the time of his inspection of the samples the indications of the dials, which automatically record the quantity and strength of the liquor produced.
4. At the time of the introduction of this system into a distillery, a minute description and drawing must be made of the relative position and size of the several parts, especially the diameter and length of the different pipes, the number of pieces of which they are composed, the indications of cracks, patches, or solid rings, the materials of which the tanks are constructed, the position of knots, splices, evidences of previous repairs, and other peculiarities of importance in ascertaining in subsequent inspections whether changes have been made. This drawing and description are to be kept in the office of the Assessor, for reference, and a copy transmitted to the Commissioner of Internal Revenue.
5. If an inspector shall fail to report any changes in the arrangement or in the apparatus from its normal condition, he should be deemed guilty of contrivance with the distiller in defrauding the Government.

The simplicity and the efficiency of the apparatus seem to insure its unfailing accuracy. Having inspected the machine, or machines, (for there are two), we will endeavor to convey an idea of their operation. The first machine is simply a beam balance poised on knife pivots in the ordinary way, and having at the short end a tank of a peculiar form, which, when one compartment is filled, reverses, emptying its contents and presenting another compartment to receive the spirit from the worm pipe. The depression of the short end of the lever, when the tank is full, actuates an arm that gives motion to gearing moving an index hand that traverses over a dial plate and records the quantity passing through. This dial, or its machinery, connects with a succession of dials, decreasing the movement of the pointers by tenths in the manner of the gas meter, so that the registration of the products of months and years may be recorded.

The apparatus for registering the strength of the run is on precisely the same principle—weight of the liquid. At the short end of the balance lever is a receptacle for the spirit and at the other end the beam traverses between two inclines on steps of which rest weights, which are taken up by the beam in succession as the end of the beam rises. The movement of the beam actuates a slide having an eccentrically curved face, which moves an index pointer by the medium of a friction clutch. There are trains of gearing as in the other machine, which operate other index pointers to record higher numbers by tenths, hundreths, etc. Besides these records there is a provision for running off a minute portion of the still for examination.

The whole apparatus is confined in an iron safe, enameled so that no tampering with it can be undetected. By means of the dials, covered with thick plate glass, the distiller or the inspector can at all times know the quantity and quality of the run.

Without diagrams we cannot exhibit the construction of these simple machines, but from the above the reader will be enabled to gather some idea of the principle employed.

ESTIMATING GUNS IN HORSE-POWER.

Eight pounds of powder fired in the old thirty-two pounder is able to give a thirty-two pound ball a velocity of sixteen hundred feet per second. It will be seen that these figures have a very simple relation to each other (1 : 2 : 4 : 200) and for this reason, and because they have been confirmed by many experiments they are familiar to all artillerists. Powder, 8; ball, 32; velocity, 1600—are household words with scientific gunners, and the old 32-pounder is very properly taken as a standard with which to compare guns of other caliber and other construction.

Now what is the force represented by the mass or weight, 32, having a velocity of 1600? How great is it, and what can it do? One of the measures of force is comprised in the formula mv^2, which applied in the present case gives us $32 \times 1600^2 = 81{,}920{,}000$. But 81,920,000 of what? Certainly not pounds or feet or foot-pounds or any other quantity with which the common mind is familiar. The formula and the calculation are correct, but they do not furnish us clearly with the information we seek.

A common way of estimating the force of a ball is to fire it at a target of wood or iron, and note how many feet or inches it penetrates. This plan, however, although instructive and useful, is quite crude and inaccurate when the object is to make an exact measurement. The principle on which it is based, namely, the determining the amount of resistance it can overcome, or the amount of work it can do, is well enough, but the trouble is that we have no accurate measure or conception of this resistance. There is another sort of resistance, however, which we do understand, and that is gravity; and it is gravity which furnishes us the unit of measure the foot-pound, which is now in almost universal use. How can we express the force of a projectile in foot-pounds? The question resolves itself into determining the hight to which a projectile will rise when resisted only by gravity; the product of this hight in feet, with the pounds of weight, gives us the number of foot-pounds. For the calculation we need the velocity of the shot (v), the velocity acquired by a falling body in one second, (g=32). and we have the hight (h) by using the formula $h = \frac{v^2}{2g}$. Thus we find that our ball having a velocity of 1600 feet, if projected up vertically will rise to a hight of 40,000 feet. As the ball weighs 32 lbs., $40{,}000 \times 32 = 1{,}280{,}000$ foot-pounds, which last represents the force of the ball. A horse-power is 33,000 foot-pounds, and $1{,}280{,}000 \div 33{,}000 = 39$ horse-power. Thus we find that the 32-lb. ball, on leaving the gun at a velocity of 1600 feet per second, does the work of 39 horses during one minute.

We used 8 lbs. of powder, which gave us a force of 1,280,000 foot-pounds: $1{,}280{,}000 \div 8 = 160{,}000$ foot-pounds, a little more than five horse-power for a minute, as the force of one pound of powder. The 32-pounder weighs 7,500 lbs.; then $1{,}280{,}000 \div 7{,}500 = 170{\cdot}7$ foot-pounds for each pound of metal of the gun.

This kind of reasoning may, of course, be applied to any other velocity, shot and gun, and a table which brings together the results, shows at a glance some very curious and important relations. Such a table is appended.

In conclusion we have the pleasure to acknowledge our indebtedness to a paper entitled, "On the comparative strength of cannon of modern construction," read at a recent meeting of the American Academy of Arts and Sciences. The author of the paper is Professor Daniel Treadwell, of Cambridge, Mass., a gentleman who, for a long time has been distinguished for his valuable contributions to the science and art of gunnery.

	Old 32 Pounder.	10-inch Columbiad.	15-inch Rodman.	300-pounder Armstrong.	600-pounder Armstrong.
1	7,500	15,059	49,099	26,880	49,280
2	32	128	315	300	600
3	8	18	50	60	100
4	1,600	1,044	1,118	1,500	1,400
5	40,000	17,030	19,530	35,156	30,625
6	1,280,000	2,179,840	6,151,950	10,546,800	18,375,000
7	1·00	1·69	4·73	8·24	14·35
8	39·0	66·0	186·4	319·6	556 8
9	170·7	144·7	125·3	392·4	372·8
10	160,000	121,102	123,089	175,780	183,750

1. Weight of gun, lbs.
2. Weight of shot, lbs.
3. Weight of Powder, lbs.
4. Initial velocity of shot, feet.
5. Right to which the shot would ascend if fired upward *in vacuo*.
6. Force in lbs. raised one foot.
7. Force compared with a 32-lb. shot under a velocity of 1,600 feet a second.
8. Force in number of horses working one minute.
9. Number of pounds of shot raised 1 ft. by each pound of metal in the gun.
10. Force of 1lb. of powder in foot pounds.

It should be borne in mind that the increase of resistance occasioned by rifling is not taken into the account, although it makes an important item against the Armstrong guns.

BUSINESS AND MANUFACTURING ITEMS.

Cotton.—The new Tecumseh mill, Fall River, Mass., in which work was commenced a few weeks since, will contain 20,480 spindles and 480 looms, will employ 250 hands, and turn out about 18,000 yards of 64x64 printing cloth per day. Much of the machinery was made in England.——A cotton manufacturing company has been started in Claiborne Parish, Louisiana, near Homer, with a cash capital of $40,000.——It is understood that the Sprague corporation will commence operations at Augusta this season by erecting dwellings for the large number of workmen to be employed upon their extensive buildings. They are now running the existing cotton mill on their recent purchase, with about 150 hands.——All the cotton and woolen mills at Westerly and Stillmansville, R. I. are idle, the operatives having "struck" against a proposed reduction of 15 per cent on their wages; which probably does not annoy the proprietors just now.——The cotton mill at Wesson, Miss., is spinning about 1,000 pounds of cotton per day, and its looms are now ready to make homespun. The company will soon put up machinery for making woolen goods.——Augusta, Ga., cotton mills are sending sheetings to New York.——The cotton mills in Petersburg, Va., have used 1,116 bales of cotton since the first of the year.

Iron.—The International Screw Company, at Northampton, Mass., is nearly ready to begin operations.——The Boston Commercial Bulletin says that Wm. Jeffers, a fire engine builder of Pawtucket, R. I., has turned his attention to the building of steam fire engines, pronounced by competent judges fully equal to those made by the Amoskeag Co., so celebrated in this country and in Europe. Mr. Jeffers has turned his inventive faculties to the construction of a little pleasure steamboat, which will run in four inches of water.——Capitalists are talking of an iron mill in Steubenville, Penn., on grounds where the power that drives the mill can be applied to hoisting coal out of the earth to run it.——The new Arms Company at Newburyport, Mass., will soon commence operations.——The manufacture of the Low-water Reporter is soon to be commenced at Newburyport. The company owning the patent has a capital of $40,000.——The new Sewing Machine Factory of the Wheeler & Wilson Company at Bridgeport, is 370 feet long, and covers nearly three acres of ground. It will contain 998 windows, and is fire-proof.

Wines.—There are two million two hundred thousand owners of vineyards in Frauce, one thousand varieties of wine made, five million four hundred and thirty-five thousand acres of land devoted to vineyards, and in 1864 the yield of wine was one hundred and thirty-two millions of gallons, worth one hundred millions of dollars. The land used for vineyards is to a great extent upon hills where other crops would be unprofitable.——Of American wines, California and Ohio yielded in 1866 more than a million of gallons; Kentucky, 180,000 gallons; Indiana, 88,000; New York, 61,000; North Carolina, 54,000; Illinois, 47,000; Connecticut, 46,000; Virginia, 40,000; Pennsylvania, 38,000. One western manufacturer paid last year an average of 12½ cents a pound for all the grapes offered.

Miscellaneous.—More home-made "protection," is advertised by the town of Fayetteville, Vt., which offers a bonus of $5,000 to any one who will invest as much more in a saw or grist mill in that place.——An order was lately received in San Francisco from Japan for $10,000 worth of leather, to be used for military accouterments.——It is said that Florida produces lemons weighing over a pound, and twelve inches in circumference, obtained by a cross between the common lemon and the sour orange.——A company is forming in New York, with a capital of $9,000,000, to introduce the cultivation of coffee on a large scale in South Florida. It is proposed to engage about 2,500 laborers.——Over seventy new manufacturing establishments are either just opened or will soon be opened in Michigan, Illinois and Wisconsin.——A manufactory of fertilizers is to be started at Falmouth, Mass., with a capital of $1,000,000(?).——A large paper manufactory is to be erected in Camden, Me. The town has voted to exempt it from taxation for five years.——The new paper companies at Holyoke, Mass. (the Valley and the Riverside) will soon begin operations.——A paper mill has been erected at Golden City, Colorado, which will be turning out paper by the first of June.——There are eleven breweries in Erie, Penn., with an average capacity of 200 barrels per day.——Piqua, O., is to have a flax mill, 80 feet long, 40 feet wide and three stories high.——During the past year ten porgy oil factories have been erected in Damariscotta, Me. at a cost of $5,000 each.——A large sugar refinery has just been started in Portland, and another is getting organized in Bath. The great Portland cordage factory is also making progress in subscriptions.——The works at Chatsworth, Ill., have turned out about 100,000 pounds of beet root sugar, during the past season. The machinery was made in Europe, and is very costly.——The manufacture of glass was commenced at La Salle, Ill., in 1865. The sand found in that vicinity is well adapted for glass-making, and two other glass-factories have recently been started there. The people of La Salle call it the "Pittsburg of the West."——The Coys-Hill Cheese Company have begun to build a factory in Warren, which was to commence operations the first of this month with the milk of 350 cows.——The cheese factory now going up at Essex, Vt., will be 100 by 32 feet, two stories high, and will cost about $4,000.——The Methuen (Mass.) Woolen Co., propose to erect a new mill during the coming summer.——The preponderance of manufactures in proportion to population in the chief Eastern cities of the Union apparently belongs to Philadelphia, in which city the yearly product is equal to $240 per head. Next comes Boston with $212, and New York third, with $197: although the cheaper suburbs of New York locate a vast portion of the manufacturing industry of the metropolis proper, and if counted, with their population, in the estimate, might give a different turn to the scale. Looking at the gross amounts, we find in New York a product of about 160 millions a year, in Philadelphia 136 millions, and in Boston 38 millions.——The first locomotive built in Pittsburg was turned out a few days ago. It is a magnificent piece of workmanship, and was built for the Panhandle Railroad. The works are now fully under way and will be able to average about one locomotive per week.

Marine Life-saving Inventions.

The Government Commissioners for investigating life-saving devices, are still in session in this city, holding daily meetings and actively pursuing their investigations. On the completion of their labors their official report will be given to the public; meanwhile, we shall endeavor to keep our readers posted as to the more important developments, for to make a detailed report of each day's proceedings would prove more interesting to the inventors themselves than to the general readers.

The following has been the programme for the past week: Monday was occupied by the examination of safety valves and water gages. Tuesday the Commissioners proceeded down the bay on a revenue cutter, and tested several boat-detaching apparatuses and fog signals. Wednesday was spent in listening to the reading of papers on scientific subjects. On Thursday another trip was taken down the bay, and a trial of life boats and rafts was made on the Jersey coast, off Long Branch. Friday, the sixteenth session of the Board was held, and several low-water detectors and force pumps were experimented with; afterward the Commissioners proceeded to the Novelty Works, and later in the day inspected the life-saving devices provided on the steamers *Great Republic* and *Celestial Empire*, the new boats of the Pacific Mail Steamship Company.

A New Route Across South America.

By a recent naval exploration the navigation of the tributaries of the Amazon which rise in Peru has been extended to within 70 leagues of the Pacific ocean, at the seaport of Huachio, 63 miles northwest of Callao. The completion of this short link by railroad will be effectively stimulated by the exploration, and the commerce of Peru and other Pacific countries with Europe and the United States, will soon flow through the Mediteranean of South America instead of the tedious and dangerous route by Cape Horn.