

# SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XVI.—No. 3.  
[NEW SERIES.]

NEW YORK, JANUARY 19, 1867.

\$3 per Annum  
[IN ADVANCE.]

## Improved Traction Engine.

It is well known that the traction engine is largely used in England for farm and draft purposes, but it has not yet assumed the same importance here.

For agricultural labors Americans prefer the portable engine, and whatever efforts have been put forth to produce a traction engine have been mostly directed to the completion of a successful road-running machine. The object, however, of the builder of the machines, one of which is represented in the engraving, is to produce a self-propelling steam carriage for running on common roads, or on the ice, and an engine that can be adapted to the work of the farm, to driving thrashing or other machinery, pumping from wells, watering gardens, and many other purposes.

The appearance of the machine in one form is seen by the engraving. As a carriage it presents a graceful appearance. The boiler is hung between the forks of a frame of steel, which meet on the forward axle and thence backward diverge, holding the boiler suspended in the triangle thus formed. This frame of steel, edge up, is twisted a half turn on each side of the boiler, thus acting as a spring. The engines work on an incline and drive a shaft with a chain wheel, which, by a machine chain, rotates the driving shaft and wheels. The engine is intended to give three revolutions to the first shaft to one revolution of the driving wheels, thus gaining power for ascending inclines. The difference can be multiplied to nine times. A lever in front of the driver's seat serves, by a simple mechanism, to guide the machine when used as a carriage, and a rod with handle connected to the engine shaft readily reverses the motion of the engine.

As will be seen, the machine is a complete engine in itself, capable of doing the work ordinarily done by the portable or stationary engine, and also adapted for locomotion. The inventor is confident that his machine can be made a success, as all those he has yet built perform their work admirably.

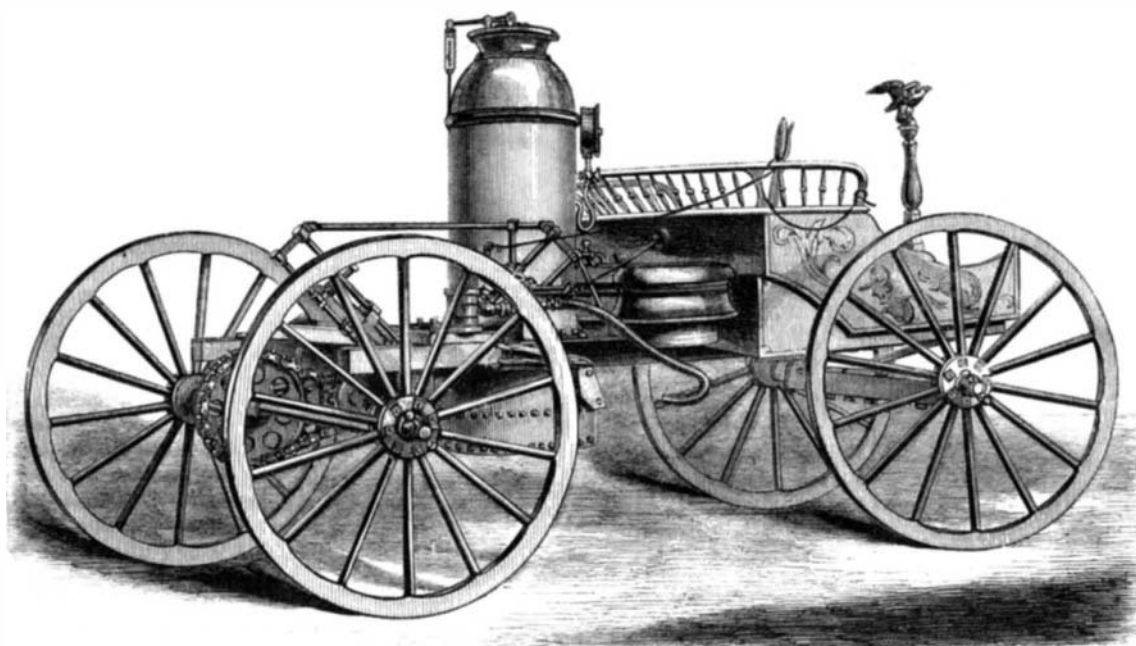
For further particulars address Elijah Ware, Bayonne, N. J.

## Sanitary House Warming.

A few months ago we presented to our readers an engraving of the Whittingham Moist Warm Air Furnace, and herewith is an engraving of the Whittingham Moist Warm Air Portable Furnace, which is constructed of cylinders forming alternately annular passages for smoke and air, in such a manner as to utilize all the heat that may be generated in the fire-pot. The products of combustion pass through the passages, A, while cold air, introduced through the bottom of the furnace and holes, B, in its outside galvanized-iron casing, passes through the passages, C. By this arrangement a very large heating surface is obtained, and as it is a well-established fact that the heat to be realized from a furnace does not depend so much on the amount of fuel consumed as on the amount of heating surface the fuel is made to act upon—(air being a non-conductor of heat, receives caloric only by contact)—this furnace embraces every quality to enable it to heat a large volume of air economically, and can be manufactured at small cost. It is estimated that one of the size represented in the engraving (scale one inch to the foot) will heat a house 20 feet wide, 40 feet deep and four stories high.

The water evaporator, D, placed in the upper part of the air chamber, is fed from the reservoir, E, upon the outside, and the vapor tubes, F, convey the vapor from it directly into the distributing air flues, G, thereby returning to the atmosphere the moisture it loses in passing through the furnace,

thus rendering it mild and pleasant, instead of dry and arid. H and I are dampers, one, H, when open to give direct draft for lighting a fire, and when closed to change its course, and



WARE'S COMBINED STEAM CARRIAGE AND ENGINE.

the other, I, to check the draft when required. J is a damper, of which there are three, to be opened for the purpose of cleaning the smoke passages.

The objections to furnace heat are happily obviated in the Whittingham furnace, as over its extensive heating surfaces an immense volume of air is warmed, and by the simple adjustment of the water evaporation into the air flues, the at-

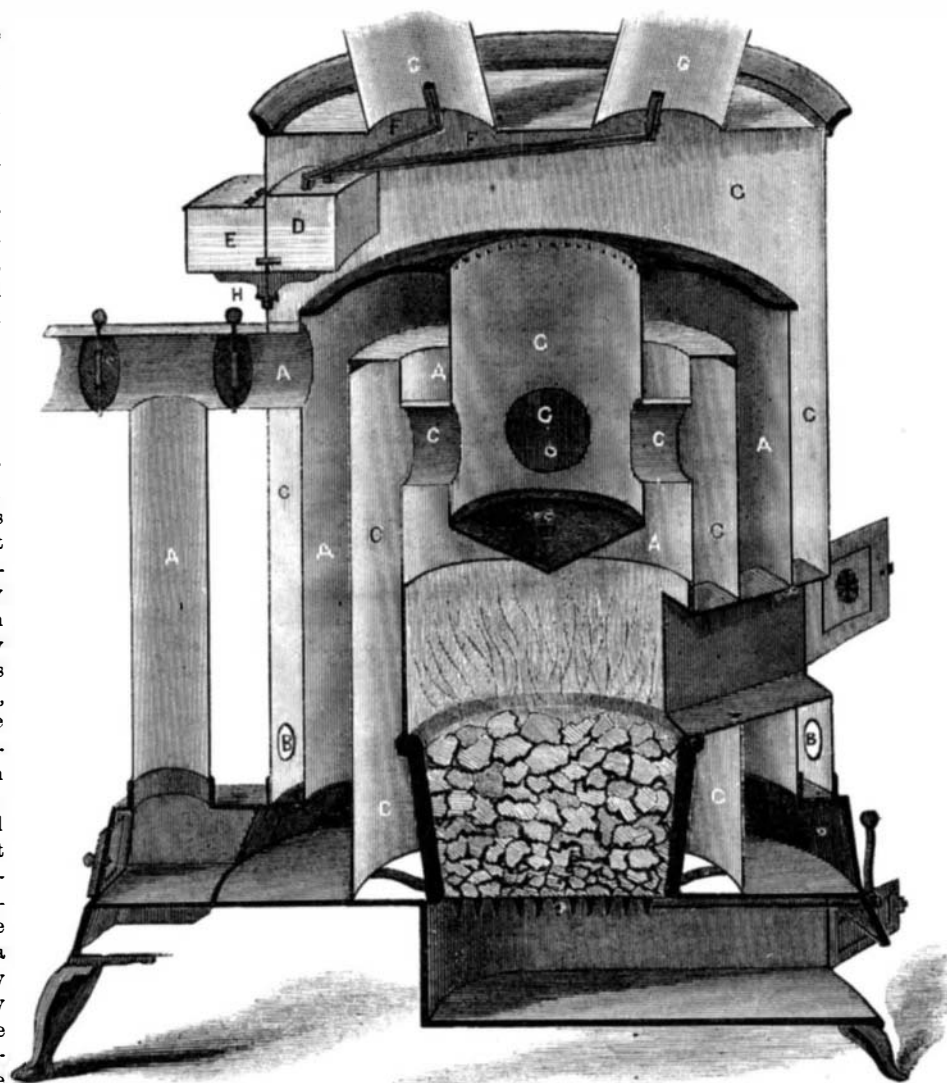
## BORAX—AMERICAN AND FOREIGN.

The recent development of this useful and interesting chemical in commercial quantities from the bed of a lake in California, naturally draws popular attention to the nature, uses and sources of the article. Its chief importance is in welding and brazing of metals. Applied to the heated surface, it at once dissolves the coating of oxide and protects the cleansed bright metal from further oxidation which would obstruct the union of the particles. It effects this by the eager affinity of its base (boron) for oxygen, with which it is always found in union, in the form of boracic acid, free or combined. The salt formed by three parts of the acid with one of soda, is the bi-borate of soda, commonly known as borax.

Boron is a very interesting substance. It is obtained chemically, in three conditions analogous to those of carbon, viz., as a dark-brown powder, a substance resembling black lead, and crystallized. The crystals constitute an artificial diamond, with the distinction that they are boron instead of carbon, some of them equalling the diamond in brilliancy, refractive-ness, and hardness, though tinted with red or yellow coloring matter, and marred by laminae of aluminum, from the boride of which the crystals are deposited. Being readily adulterated with common salt, alum, and phosphate of soda, the

purity of borax is a question of practical importance with manufacturers. It has been found containing as much as twenty per cent phosphate of soda. The new California article, as we are informed by manufacturers who have tried it, is inferior in no respect but appearance, to the best imported. But as all borax is alike susceptible of adulteration, tests may well be employed by those who wish to produce superior work in metals. Alum may often be detected by the taste, and also by adding ammonia to a solution in water which converts the whole into a thick jelly by precipitation of the alumina. Litmus paper also reveals the acid reaction of alum in turning the blue to red. Phosphate of soda may be detected by exposing the borax to the heat of a drying room for a few hours, when the phosphate will effloresce, and may be picked out.

Borax is found in a crude state in Thibet and Persia, on the borders of certain lakes, the waters of which also yield it by evaporation. It also abounds in the great sandy desert extending inland from the coast of Peru and Ecuador to the Andes, and is here much mixed with borate of lime. The refining of crude borax has been carried on for centuries at various Mediterranean seaports, principally Venice, whence the general name Venetian borax, as applied to the refined article. Our importations of crude and refined borax, mostly the latter, as shown by the custom-house returns, amounted to 655,976 lbs. in the last four years, or an average of about eighty-two tons per annum. But this amount is not more than one third of the quantity really imported, as the difference in duty has induced the importation of Italian boracic acid, to be manufactured here, by the addition, as above noted, of 33½ per cent of soda. Probably the average annual consumption in the United States does not vary very far from 500,000 lbs.: an



THE "WHITTINGHAM" MOIST WARM-AIR PORTABLE FURNACE.

mosphere is tempered to the mildness of a spring day.

Patented through the Scientific American Patent Agency, by Henry Whittingham, and manufactured by Wm. H. Church & Co., office and salesroom No. 211 Water street, New York City, of whom further particulars may be obtained.

amount which the California borax lake, if we may believe reports, is already yielding, with 300,000 lbs. more for exportation, and an unlimited supply in prospect. In consequence of this, the importation has virtually ceased. At the same time, the Italian article has been deteriorating for some time by the increase of foreign ingredients as yielded from the earth, and

from this symptom an ultimate failure of the supply began to be apprehended.

The manner in which the laboratories of nature supply this article, is the most interesting part of our subject. It appears to be one of the choice ingredients which nature has reserved with peculiar care; for it is evolved only in a very few volcanic regions, and from its limited accumulation even there, would seem to be the product of comparatively recent and local volcanic action.

The Tuscan boracic region covers some thirty square miles of wild mountain land, where the heated and undermined crust trembles to the boiling and rumbling of the waters beneath, and breaks open in numerous fissures, giving vent to jets of steam impregnated with the vapors of sulphur, boracic acid and other minerals.

Borax Lake, in California, occupies apparently the crater of an extinct volcano, elliptical in form, and about three quarters of a mile in mean diameter. It is situated on a peninsula embraced within the waters of Clear Lake; a sheet of water about twenty miles long, situated in the Napa valley, about one hundred miles north of San Francisco.

REPORT OF THE REVENUE COMMISSION.

The report of the Special Commissioner of the Revenue, DAVID A. WELLS, is a document which every intelligent citizen of the United States owes it to himself and his country to procure and study. It is not a newspaper article, to run the eye over among other things. It is a work of science, research, and philosophy; condensed into a pamphlet, it is true, but containing more matter, more meaning, and more instruction, than almost any book, so-called, that we can think of among the publications of years.

We would gladly give the report to our readers entire, did space permit. We can only glance at the main features, in the hope of inducing some of "the plain people" who govern the country at last, to make it their business to get and digest the whole.

It appears that the \$50,000,000 lost to the revenue by the whiskey frauds and cognate operations which have pervaded the whole liquor business of the country, have not been saved to the drinkers, but have mostly gone into the pockets of manufacturers and knavish revenue officers. The average consumption being 40,000,000 gallons per annum, would yield at two dollars a gallon, a revenue of \$80,000,000. Less than \$30,000,000 were actually paid on only three-eighths of the amount made and sold; and yet the average ruling price, notwithstanding exceptional cases of which much has been said, has been nearly equal to the cost of manufacturing plus the tax, showing that in general the people have paid the tax, although their Government has not got it.

The tax on carriages, watches and plate, is condemned as too inquisitorial, annoying, and expensive to collect, in proportion to the revenue derived therefrom. The tax of three

cents per pound on raw cotton, is recommended to be retained. The general tax of five per cent on products and sales of manufacturing industry, should be reduced to three per cent, with a proportional reduction of the specific taxes. The taxes on the manufacture of salt, emery, sulphuric acid, bar, plate and sheet iron, and on the elements of the manufacture of steel, to be entirely removed, and that on refined sugar to be reduced from two and a half per cent to one per cent. The decided opinion of the Commissioner is that a rapid reduction of taxation, rather than a rapid reduction of the principal of the public debt, is at present the true policy of the Government, and that the adoption of this course, so far from protracting the period in which the national debt can be discharged, will, on the contrary, greatly shorten it.

The taxes bear an excessive proportion both to the population and the public debt. The amounts for the late fiscal year were: Internal Revenue, \$310,906,984, currency, and customs, \$179,046,630, gold; a total of \$561,572,260 in currency. Our domestic manufactures are taxed \$178,000,000; business (licences) \$18,000,000 (gross receipts) \$11,000,000; incomes, \$68,000,000; banking, \$12,000,000; stamps, \$15,000,000. We pay an average of \$16 04 currency, or \$11 46 in gold, for every man, woman, and child in the country, while our public debt averages per capita \$74 38. The worst-taxed country (ours excepted) in the world, Great Britain, pays \$10 92, with a public debt of \$125 per capita. France pays \$7 97, and Austria but \$5 27. The ratio of taxes to property with us is almost 4 per cent. In Great Britain it is nine-tenths of one per cent.

Furthermore, it should be remembered that taxes in Great Britain are levied in such a manner as in the least possible degree to enhance prices—all of the ordinary forms and products of industry being exempt from taxation; while in the United States the exemption of any form of capital or process or result of industry is the exception rather than the rule. Thus, in Great Britain, in 1865, 27 1/2 per cent of the revenue was derived from liquors and tobacco, while in the United States, with at least a double consumption, the percentage of receipts from the same articles was only 5 5/8 per cent.

In respect to the tariff, it is shown that the average of duties is now 48 5/8 per cent, and 43 1/8 per cent on everything imported, not excepting gold: a very high average of rates, but so distributed in many cases as to tax our industry oppressively for its raw materials, while admitting the products of competing foreign industry on terms favorable to the foreigner and ruinous to ourselves. The increase of imports for 1866 above all previous years, is frightful: \$437,638,966, against an average of about \$300,000,000 for the seven preceding years, and an increase of over \$300,000,000 from 1865. At the same time a table of exports is presented, showing the falling off in most of the leading branches specified, to be from fifty to seventy five and even eighty five per cent. In the shipping business, the same disastrous picture presents itself.

Contraction of the currency is forcibly advocated. The circulating medium does not advance in the same ratio with the exchanges which it serves to carry on. In the State of New York, in the ten years from 1850 to 1860, the capital of banks increased 101 per cent, loans and discounts 75 per cent, deposits 113 per cent, and specie 141 per cent; while the circulation increased only 15 per cent. Before the war, the creation of currency in most of the States was free from any serious restraint. Speaking generally, therefore, the people of the United States had all the circulating medium which they required or would receive. And how much was it? Under this free system the utmost ever called for (and that in the fevered summer solstice of 1857) was less than two hundred and fifteen millions. Now the existing circulation exceeds seven hundred millions. The retaining of the present amount of currency in circulation tends to increase no business except what is speculative, and to check the very development which is expected to prove remedial of the excess. But we must refer the reader to the report itself for the full argument and the answers to all objections.

We reluctantly forego republishing Mr. Wells' masterly argument with the producers of crude commodities, that their interest, with that of all classes, demands the encouragement of manufacturing industries around them. The report must be left to speak for itself. It is unanswerable and exhaustive. We close with a few items of home interest, which every one of either sex will read.

ADVANCE IN PRICES.

A somewhat extended investigation respecting the advance in the prices of the leading articles of consumption and of rents, indicates an increase of nearly ninety per cent, in the year 1866, as compared with the mean of prices during the four years from 1859 to 1862. The breadstuffs is estimated at about 70 per cent; coal (anthracite), from 60 to 70 per cent; salt fish, from 70 to 75; provisions (pork and beef), from 110 to 130; butter, over 100 per cent; rice, 100; salt, from 110 to 120; soap, from 80 to 90; brown sugars, from 70 to 80; coffee, from 30 to 40; and teas, from 140 to 150 per cent. As regards textile fabrics, the current prices of Domestic Cottons in October, 1866, show a nominal advance over the gold prices of such fabrics in July, 1860, of one hundred and seventy-two (172) per cent. The cost of manufacturing cotton goods in the year 1866, over the average of the years from 1857 to 1861, was 125 1/2 per cent. On manufactures of woollens suited for ordinary domestic use, the advance is estimated at 53 per cent. The advance in the price of ready-made clothing has been 50 per cent. On silk goods in general, the advance is estimated at an average of a little over one hundred per cent. As a general thing, the price of labor has not advanced in an equal ratio

with the price of commodities, although numerous exceptional cases might be quoted which seem to indicate the contrary.

ADVANCE IN WAGES FROM 1860 TO 1866.

Table with 2 columns: BRANCHES OF MANUFACTURE and PER CENT. Lists various industries and their wage increases, such as Agricultural implements (55 to 60), Bookbinding (37 1/2 to 50), and Car building (100).

[From our Foreign Correspondent.]

AMERICAN BREECH-LOADERS IN EUROPE.

BERNE, Switzerland, Dec. 3, 1866.

Permit me to tell you some things officially about gun matters in Europe, feeling that you will be interested in anything which concerns the introduction or adoption of American breech-loaders in European countries. I was present at a trial of arms in the month of October last before the Commission appointed by this Government to select guns for adoption, and found there Remington's, Spencer's, a variety of American systems for the transformation of muzzle-loaders, also a number of Swiss models for the same purpose, and some English (including the Snider), German and Prussian patterns, also the French Chassepot gun; in all some forty different arms: I presented the Winchester repeating rifle, formerly the "Henry." The final result of the trial and examination is, that the Federal Assembly, which meets to-day, is recommended by the Commission and the Military Department, to order for this Government the Winchester rifle for the entire army, 101,722, which with transformed muzzle-loaders will give the country some 200,000 breech-loaders, and in the hands of such riflemen as abound in this country, the Swiss army will be a terrible foe to meet. By the term "entire army" is meant all except the militia, who are furnished with the old transformed guns: the Winchester is adopted as a principle for the army, as a new arm. The report of the Commission on the trial to which I have alluded, gives the Winchester rifle the first place as regards accuracy of fire, rapidity, convenience in handling and freedom from liability to derangement of mechanism under the severest tests; and states broadly that it excelled all other rifles; and in accuracy, the results it gave were fifty per cent better than they had ever obtained with their best muzzle-loaders. The following figures give you some idea of the firing, which, it should be borne in mind, was done by firing from the shoulder, but resting the barrel on a stand, and with ordinary open military sights. At 300 paces, 30 successive shots, majority in a circle of 8 inches; at 400 paces, 30 successive shots, majority in a circle of 12 inches; at 600 paces, 31 successive shots, majority in a circle of 20 inches; at 800 paces, 40 successive shots, majority in a circle of 23 inches; at 1000 paces, 40 successive shots, majority in a circle of 48 inches.

The rifle was loaded and fired from the magazine 15 times in 41 seconds, including time of loading; and used as a single-loader, they found it could be handled with more facility than any other arm; in fact, taking the Prussian position for firing from the hip, the soldier need not look at his gun to load and fire it, but can constantly keep his eyes upon his enemy.

As an instance of the expertness of some of the Swiss riflemen, I would say that I have seen one of them with the Winchester military rifle, fire off-hand ten successive shots 583 yards, and the average variation of the shots on the target was only twelve inches from the center. The Chassepot gun, of which so much has been said, is no more nor less than another needle-gun, and the inventor whose name it bears, and who is a member of the French Artillery Examining Board, claims only the idea of inserting on the breech-pin behind the cartridge, a disk of india-rubber, which expands by force of the explosion of the charge, so as to prevent the gas from escaping behind. Notwithstanding the reported adoption of this gun by the French, I know that they are even more interested to see new arms now than ever before, and to my personal knowledge have not yet settled upon any model of that arm, as satisfactory.

The papers contain various rumors of the adoption of various arms by different governments; but, as far as I can learn from official sources, they are entitled to very little credit. HENRY A. CHAPIN.

[Our Foreign Correspondent.]

UNDERGROUND RAILWAYS.

ENSWORTH, ENGLAND, Dec. 7, 1866.

MESSRS. EDITORS:—I have no practical engineering knowledge, therefore I must claim your indulgence if my note is somewhat confused. I had prepared a letter for your perusal on the subject of underground railways, but postponed sending it, and since then I have been repeatedly in the underground railway, and all the disagreeables which had been raised against this mode of conveyance I soon found to be entirely