Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.............................$3 20

One copy, six months, postage included.............................1 60

Club Rates:

Ten copies, one year, each $2 70, postage included.............................$27 00

Over ten copies, same rate each, postage included.............................2 70

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VOLUME XXXI, No. 18. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, OCTOBER 31, 1874

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(Illustrated articles are marked with an asterisk.)

A PANIC AT THE PATENT OFFICE.

General Leggett, the Commissioner of Patents, some time ago announced his resignation, to take effect November 1, 1874; whereupon some of the lady clerks, with natural feminine impulse, made it the occasion of presenting to the General a testimonial of esteem from themselves and associate employees. The General has been instrumental in introducing female labor in almost every department of the Patent Office; the clerical work of nearly all the examining officers is now done, and very acceptably too, by women. The ladies procured donations from the various examiners and assistants, with which a handsome tea set was obtained and presented to the retiring Commissioner.

It is not perhaps strange that the General and his corps of ladies should have overlooked the law which forbids such doings; but that disinterested persons, like the Assistant Commissioner, members of the Board of Appeals, examiners-in chief, and other legal minds connected with the office, should have been so unobservant seems remarkable. The provision of the statute is very stringent, and is as follows:

"Be it enacted, etc.: That no officer or clerk in the United States Government employ shall at any time solicit contributions of other officials or employees in the Government service for a gift or present to those in a superior official position, nor shall any such officials or clerical superiors receive any gift or present offered or presented to them as the contribution of those in the Government employ receiving a less salary than themselves; nor shall any officer or clerk make any donation as a gift or present to any official superior. Any officer or clerk violating any of the provisions of this bill shall be summarily discharged from the Government employ."

We believe it is not pretended that this statute is unconstitutional, or that for any reason it is to be treated as a dead letter. In refusing, summarily, to discharge the Commissioner of Patents and all the subscribers to this tea party, both the Secretary of the Interior and, through him, the President of the United States, are open to the charge of neglecting their plain duty.

A considerable time has elapsed since the knowledge of the above transgression of the law was made known, but the officers of the government have not as yet dismissed one of the offenders.

It is rumored that they are all to be discharged, and then all immediately reappointed. But this would amount practically to a nullification of the statute. The evident intention of the law was to place the seal of public condemnation upon all such transactions, and wholly to remove from the public service those who should be guilty of them.

In no other way can the observance of law be promoted. To dismiss and then reappoint would be to trifle openly with the law, a course which would assuredly meet with public condemnation.

There is but one way for the President to deal with this matter, and that is promptly to discharge all the parties involved from the public service, as the law specifies. To dismiss them in a body would be disadvantageous to the public service, and therefore unwise; but it should be done as rapidly as possible. He should begin with the most prominent offenders first. General Leggett, the Commissioner, should be at once dismissed, and a new commissioner appointed. Mr. Thacher's removal should follow, and so on, down, until the law has been entirely vindicated.

The removal of the Commissioner, the Assistant Commissioner, and some of the examiners would be of little personal inconvenience to them, as they can readily set up in patent business and make a living. But the affair will prove more serious to some of the other employees, who are, for the most part, honest, faithful, and deserving; and dismissal will be very inconvenient, especially at the approaching inclement season of the year. We deeply sympathize with them, and for their sakes wish that they could be excused.

Let us hope that the effect of this general change in the *personnel* of the Patent Office will be a benefit to that institution. Among its officers are many intelligent and valuable persons, whose departure will be a disadvantage to the country. On the other hand there are a number of officials whose ignorance, tardiness, and illiberality towards inventors make their removal greatly to be desired. By an entirely new organization, if intelligent care is taken in the selection of individuals, the Office will be likely to be benefited rather than damaged.

Competent persons who desire employment at the Patent Office may, we think, properly file in their applications. We assume that nothing but a special act of Congress can relieve from dismissal or properly re-instate the present offenders; and if any are to be re-instated, only the very best and ablest of those now in the Office should be reappointed.

The poor material must be eliminated. All who have exhibited indolence or sluggishness in the discharge of duty, all examiners of every grade who have failed to act promptly on their cases, all who have suffered their work to get behind, all who have tried to set up their dictum against the most liberal interpretation of the laws in the grant of patents to inventors: all such persons should be rigidly excluded from the service.

ECONOMY IN EATING.

Like the steam engine, the human organism is a machine for the development and application of power. Like the steam engine, it derives its power from the combustion of organic products. But, unlike the iron mechanism, man has other ends than the performance of work, and there is no one food which will meet his physical requirements, as coal or wood will those of an engine. His fuel is necessarily complex, and, still more, its complexity must be varied time to time to meet the changing demands of the seasons, of age, occupation, and other life conditions.

In choosing his source of mechanical power, the engineer takes into account the relative cost and efficiency of the different sorts of fuel to be had in his locality, and selects that kind, or such a combination of two or more kinds, as will furnish the power he needs at the smallest cost, and with the least wear and tear to his machinery. He will not burn coal where wood is cheaper, nor green wood when he can get dry.

While it is immensely more difficult to make the corresponding selection for the human machine, it is obvious that, since health and happiness, as well as working force, are involved, it is of vastly greater importance that the selection be wisely made. Yet there are multitudes who take, or would take, pride in running a steam engine economically, who not merely give no thought to their own machinery, but rather pride themselves on its apparent capacity to run well under all conditions, or in spite of maltreatment. They "can eat anything"; and so long as their food is savory and they can get their fill, they do not care what its elementary composition may be, or how much unnecessary labor it puts upon their digestive and alimentary organs to dispose of it. Mention economy in eating to them, and they straightway call to mind the pint of beans or pound of oatmeal that ignorant theorists have proclaimed as sufficient for their daily needs, and more or less politely decline to eat by rule. Others, to whom the cost of supplying food for a numerous family is a matter of serious moment, are ignorantly proud of setting as good a table as their neighbors, unconscious that their neighbors have as vague an appreciation of what is "good", under the circumstances, as they themselves have, and that the money they misspend would more than suffice to provide an abundance of food, at once better suited to their needs, more enjoyable, and, in many cases, much more wholesome.

The fact is that the much misused word "economy" is never more severely warped from its true meaning—judicious management—than in its application to domestic matters. To be economical in one's diet is commonly thought to imply the use of cheap food in preference to the costly, to restrict one's self to one dish when appetite would suggest a dozen, to eat vegetables rather than meat: in short, the reduction of the amount, the quality, and the cost of food to the minimum. On the contrary, true economy in eating requires us to select and combine the greatest variety of food so as to furnish the maximum growth or power most enjoyably, with the least waste of substance and the least tax upon the system, in assimilating what is useful and rejecting what is useless. To do this wisely, we need to know not only what the system requires under the varying conditions of life, but also the chemical constitution of different foods, their dynamic power, and how to combine them so as to develop their highest utility with the smallest functional expenditure. For example, a laboring man requires daily, to sustain his bodily temperature under ordinary conditions, to enable the vital processes of respiration, digestion, and the rest to go on well, and to meet the demands of muscular effort, an amount of power equivalent to about 4,000 foot tuns, or enough to raise a man of average weight about eleven miles, vertically. To maintain these conditions, it is found by experiment that a daily diet furnishing about 300 grains of nitrogen and 4,800 grains of carbon is required.

To obtain these 300 grains of nitrogen from bread, the laborer would have to eat rather more than four pounds, containing nearly twice as much carbon as would be needed. The carbon of about two pounds of the bread would thus be not merely wasted, but worse: the excretory organs would be taxed to get rid of it. To add butter to the bread would only increase the disproportion of carbon. On the other hand, if the laborer undertook to supply the wants of his system with lean beef, he would have to eat six pounds of it to get the requisite amount of carbon; but in six pounds of beef the nitrogen is over a thousand grains in excess of what is needed, and excess of nitrogenous matter in the blood is a fruitful source of disease. The nitrogen of nearly five pounds of beef would thus be wasted.

It appears, therefore, that neither bread nor beef is economical eating alone; but properly mixed, we should have, say: 14,000 grains (2 pounds) of bread, containing 4,200 grains of carbon and 140 grains of nitrogen; and 5,500 grains (about three fourths of a pound) of beef, containing 605 grains of carbon and 165 grains of nitrogen; total 4,805 grains of carbon and 305 grains of nitrogen. There can be no question that a diet of bread and beef would be more enjoyable than either singly. It is demonstrable that it would be cheaper and, at the same time, better suited to the wants of the system: in short, more economical.

In a similar manner, more complex diets can be adjusted, and the scientific correctness of diets, contrived to meet special conditions by long processes of trial, can be brought to mathematical demonstration.

In time our works on dietetics will tell not merely what foods are good and how to prepare them, but what is the dynamic value of each by the ounce or pound, and how they may be most economically combined to meet the varying requirements of youth and age, and the different conditions and callings in life. The researches of Payen, Frankland, Pavy, and a host of others have lately made rapid approaches toward this desirable state of things. For instance, a glance at one of Frankland's tables shows that the working force of a pound of butter oxydized in the body is equal to that of nine pounds of potatoes, or twelve pounds of milk, or over five pounds of lean beef. A pound of oatmeal will furnish as much force as two pounds of bread, or over three pounds of lean veal. A pound of lump sugar has the dynamic power of two pounds of ham or eight pounds of cabbage. Knowing the prices of these substances, their comparative values as sources of power can be easily calculated. Their relative value as food is a more difficult matter to determine, since in that case their relative digestibility and other elements enter to complicate the problem.

An extremely interesting and valuable feature of Pavy's recent work is the calculation of the dynamic values of different dietaries. For instance, Playfair's "subsistence diet," found by taking the mean daily allowance of nitro genous matter, fat, and carbo-hydrates in the dietaries of London needlewomen, of the convalescents in the Edinburgh Infirmary, of the inmates of several prisons, and of the operatives during the cotton famine in Lancashire in 1862—a diet which barely suffices to sustain life—has a force-producing value of 2,453 foot tuns a day, or enough to raise a person of light weight to the hight of seven miles. From observations on the carbonic acid excretions of several persons, Dr. Edward Smith found that the power expended daily in maintaining the body's heat is, on the average, enough to raise the body six miles. Professor Haughton calculated the power required to perform the necessary vital functions of respiration, digestion, and the rest, to be, speaking generally, enough to raise the body to the hight of one mile. The seven-mile power of the "subsistence diet" would therefore be used up without work or active exercise.

The average diet of adults in full health and with moderate exercise was calculated from the dietaries of the English, French, Prussian, and Austrian soldiery during times of peace. Its dynamic value is 4,021 foot tuns. The average of the dietaries of European and American soldiers during the great wars of recent years gave the diet assigned to active laborers. Its force value is 4,458 foot tuns. The diet of hardworking laborers, determined from the actual amounts of food consumed by railway navvies, hardworked weavers, blacksmiths, and others, is equivalent to 4,849 foot tuns. A similar calculation for the diet of a body of Royal Engineers, actively engaged, gives the high dynamic value of 5,532 foot tuns, or enough each day to lift the eaters over fourteen miles vertically. In food value, this full diet compares with the subsistence diet above mentioned (salts omitted) as follows:

	Subsistance Diet	Royal Engineers' Diet
Nitrogenous matter (dry)	2·33 ozs.	5·08 ozs.
Fat	0·84 "	2·91 "
Carbo-hydrates	11·69 "	22·22 "
	Total 14·86 ozs.	Total 30·21 ozs.

With these it may be well to contrast the standard diet of Moleschott, which is generally accepted as a fair representation of a model diet, that is, one containing the requisite combination of alimentary principles for the daily support of an ordinary working man of average hight and weight. It is as follows:

Albuminous matter	4·587 ozs.
Fatty matter	2·964 "
Carbo-hydrate	14·250 "
Salts	1·058 "
Total	22·859 ozs.

Thus about 23 ounces of dry solid matter, one fifth nitrogenous, may be taken as sufficient for the daily needs of an average adult workman. Ordinary food contains about 50 per cent of water, which would swell this amount of dry matter to 46 ounces of solid food. To complete the diet, we must allow from fifty to eighty ounces of water in addition, daily.

Of course, the varying requirements of youth and age, hot weather and cold, indoor and outdoor occupation, individual idiosyncracy, taste, and a thousand other conditions combine to vary the proportion of the several elements needed in any case; nevertheless, all such average determinations are helps toward the developed science of dietetics, which the coming years will see.

DEMONIACAL POSSESSIONS.

The devil dies hard, and the fifteenth century lingers in other quarters than Italy and Spain.

In the middle ages the unfortunate victim of morbid or insane impulses was looked upon as the sport of demons. The history of medicine records the successive steps of progress in knowledge by which this delusion was dispelled, and the true cause of these maladies was found to be organic derangement or vicious education.

A man of kindly disposition suddenly manifests an irresistible desire to kill somebody. He may say that his grandmother's ghost or the spirit of George Washington has ordered him to shed blood; but intelligent people know better. They do not assume, as of old, that some evil spirit has caught his soul abroad and has slipped in and taken possession of the vacant body for diabolical purposes. They say that something is wrong in his physical organization, a tumor on the brain, may be, and treat him accordingly. When he dies, the surgeon's knife will lay bare the cause of the difficulty, which had been slowly developing, perhaps for years before the crisis came. Does any one wonder why, at this late day, we soberly set down what every civilized child is supposed to know? or soberly discuss a theory that died with witchcraft? Simply to spring upon the intelligent reader the surprising fact that belief in witchcraft and the theory of demoniacal possessions is not dead, here, in this land of common schools and newspapers: not among the illiterate, but among newspaper readers: worse, among the editors of newspapers which profess to lead the advance of civilization.

How does this sound for the nineteenth century? We quote from a family paper bearing date October 8, 1874:

"A favorite scoff against religion has been founded on the instances, recorded in the gospels, of persons who were possessed with demons. Perhaps two items of news published recently may throw some light on the demoniacal possessions on which infidels have long exercised their wits." The paper goes on to describe the case of the Pomeroy boy of Boston, and that of a girl in this city who felt a strong desire to burn an infant she was nursing, but fortunately confessed the desire before attempting its execution; then it continues: "These are two of the latest startling items of news. Do they not look as if the devil had more power over human nature than he is ordinarily credited with? In view of them, can we say that demoniacal possessions are impossible?" This is from the *Christian Observer*, and is quoted approvingly by another *Observer*, which puts *New York* as part of its title, but is presumed to be Christian all the same.

We do not know the circumstances of the last mentioned case, nor the history of the girl whose homicidal desire was kept from being carried out. Cases of the kind, however, are not uncommon, and not unaccountable, without the devil's assistance. As regards the Pomeroy boy, there was never a clearer case of moral warping by vicious influences, systematically brought to bear on the child *in utero* as well as in infancy. Had the mother's desire been to breed a monster of bloodthirstiness, her course could not have been more surely adapted to accomplish that end. And the mother's morbid pleasure at the sight of blood was not only inherited but cultivated by the child, who was a butcher by instinct, taking up his father's trade almost as soon as he could walk. Yet we are gravely told that this boy's horrid desire to see how a child would die was due to his momentary possession by the devil!

This is worse than the experience of a medical friend, who, calling the other day to learn the effect of a prescription for a sick child, was greeted by the mother with the triumphant exclamation. "I don't think baby will have convulsions any more!" "Ah!" said the doctor; "why not?" "*I've burned his shirt!*" The lady is the wife of a wealthy merchant and a member of polite society. Very likely she reads the *Observer*: possibly both of the papers of that name.

REPORTS ON SMALL ENGINES.

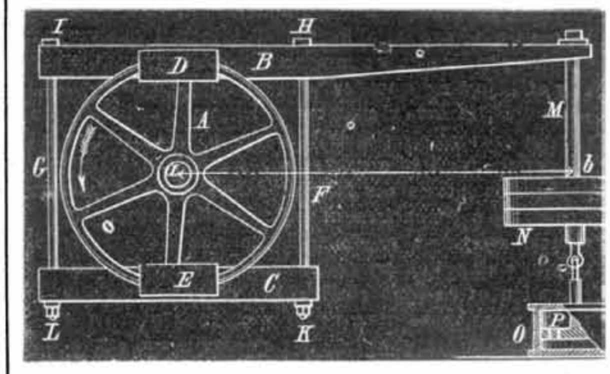
We have been much gratified, of late, by the receipt of letters giving particulars of small engines and boilers. Data of this kind are extremely valuable, showing the results of actual practice, and we hope to receive many more letters of the same kind. These accounts would be more interesting and useful, however, if they contained fuller details of the performance; and we propose to give some account of the manner of making a test. The apparatus needed is quite simple, and can be readily constructed by the young mechanic. The following embrace the principal points that are generally of interest in regard to engines and boilers: Diameter of cylinder, length of stroke, diameters of piston rod, connecting rod, crank pin, valve stem, fly wheel, and shaft; lengths of connecting rod and crank pin, weights of whole engine and of fly wheel, size of ports, stroke of valve, point at which steam is cut off, number of revolutions per minute, clearance at each end of cylinder, pressure of steam in boiler, dimensions and weight of boiler, diameters of steam pipe and safety valve, number of pounds of water evaporated, fuel burned per hour, and power of the engine. Many of these data are obtained at once, by direct measurement or weight. The diameter of the cylinder should be measured when it is at the temperature at which it is ordinarily maintained while running. The point of cut off can generally be ascertained by removing the cover of the valve chest, and observing the point at which the steam valve closes when the engine is moved by hand. This should be done when the parts are heated. The clearance at each end of the cylinder includes not only the space between the piston and cylinder head at the end of the stroke, but also the volume of the ports. A simple and accurate manner of measuring the clearance is to fill the cylinder with water, when the piston is at one end of the stroke, and then measure the water carefully in a cylindrical or rectangular vessel. The difference between the volume of the water and the volume of piston displacement (area of piston multiplied by length of stroke) will be the clearance. In measuring the piston displacement at the front end of the cylinder, the volume of the piston rod (area of section of rod multiplied by length of stroke) must, of course, be deducted.

The number of revolutions of the engine per minute can be determined approximately by observation; but errors are apt to result, especially in the case of small engines moving at a high rate of speed. Small shaft counters can be obtained at a very reasonable price, and measurements made with them are far more likely to be accurate.

Many small boilers are not provided with steam gages, so that the pressure of the steam cannot be observed directly; but all such boilers have, or should have, safety valves, and the pressure of the steam can be determined from them. Secure the valve stem of the safety valve to the lever, with wire or string, and attach a loop to the lever, into which pass the hook of an accurate spring balance, arranging the loop so that it is directly over the center of the valve stem. Then take hold of the upper part of the spring balance, and lift the valve slightly, noting the reading of the balance. Measure the lower diameter of the safety valve, and find its area; divide the reading of the spring balance by the area of the valve, and the result will be the pressure, in pounds per square inch, at which the steam will raise the safety valve. Suppose, for instance, that the diameter of the safety valve is 1 inch; its area will be about $\frac{7854}{10000}$ of an inch. Now, if the tension of the spring balance in raising the valve is 120 pounds, the pressure at which the valve will rise is the quotient arising from dividing 120 by $\frac{7854}{10000}$, or 153 pounds per square inch. It will be easy to make a table for any particular case, giving the pressure corresponding to each pound or fraction of a pound of tension in the balance; and by calculating in advance the reading of the balance for any given pressure, the weight can be adjusted on the lever until that tension is obtained, and the valve can thus be graduated to lift at any required pressure. It may be added that this simple method is applicable to any safety valve, and affords a ready means of testing the accuracy of the graduation; but at present we are treating of this method only with a view to explain how the steam pressure in the boiler may be ascertained at any time. Having determined the pressure at which the safety valve will rise when the boiler is cold, raise the valve by means of the balance, from time to time, when the engine is working, and observe the tension. Find the pressure corresponding to this tension, and subtract it from the pressure at which the valve will be raised by the steam. The difference is the pressure in the boiler at the time. For example, suppose that in the last case the tension of the balance, on raising the valve when the engine was working, was 50 pounds. The pressure corresponding to this will be 50 divided by $\frac{7854}{10000}$, or about 64 pounds, so that the pressure in the boiler at the time would be the difference between 153 and 64, or 89 pounds per square inch. By preparing a table showing the pressure in the boiler due to each pound of tension in the spring balance, the pressure at any time can be read off as soon as the indication of the balance is observed.

The amount of water evaporated per hour and the fuel burned can, of course, be readily determined by measurement, drawing the water from a tank of known dimensions, and observing its state at the commencement and close of a trial, being careful to leave the water in the boiler at the same hight at which it was at the commencement, and maintaining this hight as constant as possible during the experiment. In measuring the fuel consumed, it is best to draw out the fire at the commencement of the trial, rekindling it as soon as possible, and charging all the fuel used from that time, hauling and quenching the fire immediately at the close of the trial, and weighing back all fuel that is unconsumed. In the case of small boilers heated by lamps, a measurement of the oil used between the beginning and end of the trial will generally be sufficient; and if gas is employed as fuel, it will be necessary to attach a meter to the pipe, to determine the quantity consumed in any given time.

To ascertain the power of the engine, the most convenient method is, generally, to attach a friction brake, shown in the accompanying engraving, to the band wheel. Hollow out two pieces of wood, B and C, so that they will fit the circumference of the band wheel, A, and attach light plates of metal, D and E, to the sides, so that the pieces of wood cannot slip off when secured in position. Provide two belts, F, G, countersinking the heads, H and I, into the upper piece



of wood, so that they cannot turn, and put nuts and washers, K and L, on the other ends, so that the two pieces of wood can be clamped on the band wheel as tightly as is necessary. Make the upper piece of wood somewhat longer than the other, and pass a rod, M, through the end. On this rod weights, N, are to be placed, and the lower end of the rod is hooked to the piston rod of a small cylinder, O. The piston, P, fits loosely in this cylinder, which is filled with oil or water; and the piston has small holes in it, so that it can move up and down without much resistance, if moved slowly, but offers considerable resistance to sudden motion. The action of the apparatus will doubtless be apparent to our readers. By tightening the nuts on the bolts, F, G, there will be considerable friction between the band wheel and the pieces of wood. The rod, M, must then be loaded with sufficient weight, so that the engine can just move at its regular rate of speed, and keep the upper piece of wood in a horizontal position. The friction on the band wheel will cause it to become heated, unless some arrangements are made for cooling, either by keeping a stream of water running upon it, or immersing the lower part in a trough in which the water is constantly changed. The small cylinder, O, and piston, P, serve to counteract the effect of sudden shocks, which would otherwise throw the arm of the piece, B, from a horizontal position. Now it will be plain that, as the band wheel revolves (constantly maintaining the arm, with the weight attached, in a horizontal position), the effect is the same as if it were lifting this weight by means of a rope running over a windlass, and the distance through which it would lift the weight in a given time is the same as the weight would move if the whole apparatus were free to revolve. If, for example, the wheel makes 300 revolutions in a minute, the distance from the center of the wheel to the center of the weight is 1 foot, and the weight is 10 pounds; this weight, if free to revolve, would move in each revolution through the circumference of a circle whose radius is 1 foot, and in a minute would move 300 times as far, or about 1,885 feet. The work of the engine in a minute, then, will be that required to lift 10 pounds through a hight of 1,885 feet, or 18,850 foot pounds; and as one horse power is the work represented by 33,000 foot pounds per minute, the engine would be developing a little more than half a horse power.

In making experiments with the friction brake, the apparatus should be placed loosely on the band wheel; and before the weights are attached, a spring balance should be secured to the arm, at the center of the hole for the rod, M, and the reading noted when the arm is in a horizontal position. This reading must be added to the weights that are afterwards attached. The horizontal distance from the center of the wheel to the center of the rod, M, should be carefully measured. Then start the engine, with the throttle valve wide open, and screw up the nuts, K, L, gradually, adding weights at N. It will then only be necessary, when sufficient weights are added, to keep the wheel cool, and occasionally adjust the nuts, K, L, should the brake bind or become too loose from any cause. Should it be difficult or inconvenient to maintain the arm in a horizontal position, note carefully the position it assumes during the test; and for the radius to be used in the calculation, measure the distance, *a b*, from the center of the wheel to the center of the rod, M, in a direction perpendicular to the direction of the rod.

Instead of the weights, N, and cylinder, O, a spring balance may be attached to the end of the rod, M, and secured to some fixed support, its readings during the trial being used in place of the attached weights. In this case, also, the weight of the apparatus must be first determined, and added to the readings of the spring balance. The plan represented in the engraving is, however, the best.

We have thus described, in detail, the methods to be pursued in preparing a report of the performance of small engines and boilers. Although they are far from fulfilling all the requirements of a scientific test, they will give very accurate results if carefully conducted. Should any of our readers make the experiments referred to in this paper, we shall be glad to receive the results, with full particulars.

THE PHYLLOXERA.—R. J. writes to assure us that 1 pint slaked lime, mixed with half a peck horse manure, put round the roots of each vine, will ensure a speedy cure for the disease, protect the plant from frost, and give it a vigorous growth. This remedy, which has been tried and found successful, should be applied in the fall of the year. He offers us half the reward.