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WORKING STEAM EXPANSIVELY.

In page 281, current volume of the SCIENTIFIC AMERICAN, we presented a condensed review of the steam experiments conducted at Erie, Pa., as obtained from the recently published report of the Board of Naval Engineers. These experiments, according to our view of the question, have proven that there is no saving in expansive steam of low pressure—that which is commonly carried on our low pressure steamboats. It is exceedingly important to know this; these experiments are therefore very valuable to the engineering world. We will now give some information on the other side of the question.

The London *Engineer*, in a recent article on this topic, asserts, that while non-expansive engines require 30 lbs. of water per horse power in the hour, there are expansive locomotives and Cornish engines which only require from 15 to 25 lbs. This shows that a saving of fifty per cent may be effected in an engine working steam expansively, when it is properly constructed. We have also seen several statements published by our foreign cotemporaries, respecting a peculiar economical compound class of engines called the "Rowan Patent," which have lately been applied to several British steamers. These have a small high pressure cylinder connected with a large low pressure one; the steam is admitted into the former at 100 lbs. pressure, and is exhausted into the large cylinder, where it is expanded down under 11 lbs., before it is exhausted into the condenser. An American engineer, lately returned from Europe, has assured us that the saving of fuel in these engines is perfectly astonishing; they run with less than two pounds of coal per horse power in the hour, whereas six and seven pounds is the common consumption in other marine engines. These facts are all in favor of working steam expansively.

In a late number of the *Journal of the Franklin Institute*, Robert J. Thurston, engineer, gives his experience, and presents several indicator diagrams in favor of expansion. He states that the most economical engine carrying full pressure, tested by him, is one built at Wilmington, Del., which runs night and day in a warm engine room; its consumption of coal is four pounds per horse-power per hour. On the other hand, he states that an expansive working engine, built at Providence, R. I., only consumes two and a quarter pounds of coal per horse-power. The higher the pressure of steam carried, and the greater the range of expansion, the greater has been the economy of fuel in this engine. These facts are also in favor of expansive working, when the engine is properly constructed for the purpose.

According to the science of steam, as it is understood by intelligent men, it is very unsatisfactory to assert that a great loss is caused by the condensation of steam in cylinders when it is used expansively. The loss of energy in steam is just in proportion to the work which it performs, and if it is allowed to be exhausted at full stroke and at a high pressure, there is a great deal of work thrown away into the atmosphere.

A correspondent—Mason Hearsey—writing to us from Ionia, Mich., on this topic, states that he has tried a great many experiments with his engine, with different pressures of steam, and cutting off at different points of the stroke. When running with steam at 25 lbs. pressure, no advantage was obtained by cutting off; but when running from 40 lbs. pressure up to 70 lbs., he found a great benefit in working the steam expansively. His engine is quite small, and perhaps the advantage which he obtained in cutting off with high pressure, may have been due to a more free exhaust, and a lower *final* than *initial* pressure of the steam. He states that with a short quick stroke, and steam from 30 lbs. upwards, quite a saving is effected in cutting off at half stroke, according to his practice.

WAR, BUSINESS, AND WOMEN.

During the Revolution, Benjamin Franklin rendered as important and valuable services to the country as any other man, with the possible exception of Washington. At the crisis of the war, Washington wrote to Franklin that unless he could persuade the French government to make an advance of money, it was difficult to see how the army could be kept together; the money came and the war was soon ended. But, in the midst of these important public services, Franklin managed to keep his own property constantly increasing. Washington, too, amidst all the cares of the camp, kept a prudent watch over his private affairs; and there were many other men whose wealth steadily accumulated during that long and wasting war. The thousands of millions of dollars' worth of property which was destroyed by the British government in the twenty years' contest with Bonaparte, was contributed from the profits of business men, profits made mostly during the war and invested in the public funds.

Still, there is no doubt that, as a general rule, business is less prosperous in times of war than in those of peace. If great numbers of men are taken from the labor of producing wealth and set to the work of destroying it, the production of wealth must be diminished; and unless there is a corresponding diminution in the consumption, the accumulation must be at least checked, if not stopped. The plain way, therefore, for a people to carry on a war without diminishing their wealth, is by a general practice of individual economy. One of the most important elements in the military resources of this country is the elasticity in the habits of our people. We can adapt ourselves to circumstances. An American can make himself at home in the drawing rooms of dukes and princes, or he can sleep on straw and live on soldiers' rations.

There are thousands of ladies in the country who are anxious to know what they can do to aid the government in the great struggle which is now before us. They can do quite as much as the men. "In war," said Louis XIV., "it is the last guinea that wins." There are to be large amounts of government stocks offered in the market, and these can be bought only with the savings from private incomes. Let the growing fashion of wearing diamonds be given up. Leave to servant girls the display of showy jewelry, which they can buy at "a dollar for your choice," and let the patriotic purpose prevail of practising economy in every possible form, in order to save money to invest in public stocks. In the present state of chemical science, there is a reasonable prospect of the discovery, at any time, of the art of crystallizing carbon; if this discovery should be made, diamonds would immediately become as worthless as quartz pebbles; but United States bonds are as solid and safe an investment as it is possible to find—in the uncertainty of all human affairs.

AMERICAN MACHINES AND IMPLEMENTS FOR ENGLAND.

A very interesting paper upon this subject was read before the London Society of Arts on the 3d of last month, by C. W. Eddy, Esq., who has made a tour of the United States, and paid a great deal of attention to our labor-saving machines. He stated that the traveler could not fail to be struck with astonishment at the vast amount of labor which had been achieved—of forests cleared, lands reclaimed, canals and railroads constructed, and cities built, by a scattered population in the brief period of time that has elapsed since the country was first commenced to be peopled. About 5,000 miles of canals have been built, 30,000 miles of railway; and there are half a dozen cities, at least, which rival in magnificence a like number of the capitals of Europe. The merchant navy of America is not inferior to that of England; and the manufactures, commerce and natural products of the United States are vast, and, in some respects, unequaled. These results have been accomplished in a climate having great relaxing heats in summer, and winters of great severity. The indomitable energy of the people, aided by inventive faculties of a high order, did all this.

We will enumerate several American tools, machines and systems which Mr. Eddy stated should be introduced into England.

They consist of grain cradles, horse-powers, chopping axes, grain elevators, fence augers, spring rakes, unloading hay forks, road scrapers, small grinding mills, light carriages, stone-breaking machines, steam ferry boats with elevating landings, and floating docks.

Hitherto, the prejudice in England against foreign-made machines has been so strong as to prevent their introduction; but this bigotry is thawing away before the genial sun of increasing intelligence.

As most of our agricultural implements may be exported to England without paying duties, our makers should direct their attention to this opening for their articles.

At the close of reading Mr. Eddy's paper, Mr. Anderson, of the Woolwich Government Factory, bore testimony to the extreme ingenuity of the Americans—the skill with which they produced by machinery such articles as a great demand enabled to be manufactured by constant repetition. He considered the organization of workshops—the relations between the masters, the foremen and the workmen—more satisfactory than in England; but said that he had found no factories where the tools for manufacturing were to be compared to those in use in such factories as Maudeslay's and Field's, or Penn's.

Mr. Cassell mentioned several examples of ingenious labor-saving machines for domestic use which he had come across during his recent residence in the United States; but he showed that Mr. Eddy's idea as to the superior cheapness of certain American manufactures was erroneous. For instance, a pair of shoes which could be purchased for 11s. or 12s. in London, cost 20s. in New York. Steel and iron goods were protected by a duty of 25 per cent, which had recently been raised to nearly 50 per cent.

KEEP THE MACHINERY RUNNING.

One of our acquaintances, who is a man of great wealth, and one of the most extensive cotton manufacturers in the country, is so imbued with the patriotic spirit of the times, that he is willing to enter the ranks as a volunteer, and march into the South with the army, leaving his large business to take care of itself as it may. But he is told by the Governor of his State that he can serve his country far more effectually by staying at home, and attending diligently to his mills. There is no doubt about the wisdom of this advice. We are entering upon a great struggle, which will destroy and waste property with terrible rapidity; and the only way in which the nation can be saved from swift impoverishment and exhaustion is by a corresponding production of wealth. Let, then, the various engines and machinery, that so wonderfully multiply our power of producing wealth, be kept in unceasing operation. The proportion which the annual product of wealth in any community bears to the whole accumulated property is surprisingly large. For instance, the people of Massachusetts are worth $750 apiece in the average; and their average incomes, including the profits of the great merchants and manufacturers, is probably not less than one-quarter of this sum. The wealth of Ohio, if divided equally, would give $379 to each inhabitant; and the annual product can hardly be less than half of this amount. In all cases the consumption is very nearly equal to the production; and if the richest community in the world should stop producing the means of subsistence, and fall back upon the accumulated property, they would come to poverty and starvation in a single season. The great waste which is now going on in war can be counterbalanced only by a corresponding vigor in production. It is the very worst time for us to lay aside our numerous steam engines and multiplied mechanism.

We do not advise the manufacture of any goods that are not wanted by the community; this is worse than letting the mills lie still; but it is plain that if any

owner of a machine shop or manufactory can make any article which the community need, he can render no better service to his country than by keeping his works in steady operation.

DETERMINING DISTANCES BY LIGHT, ANGLES, SOUND AND WALKING.

Soldiers should be able to determine the distance they have traveled in marching ; also the distance of a gun by the report of its discharge ; the distance of men and horses by common observation ; and also by the angles, using a pencil, or a common foot rule, for this purpose.

In determining the distance of space traveled over in marching, it is necessary that a straight line should be preserved, or allowances made for curves and deviations. The military pace is 2 feet 6 inches ; therefore, by keeping an account of the number of steps taken in a minute, we arrive at the space traveled in one hour, or in one day. Thus, 108 paces per minute, at 2 feet 6 inches each, are 3.07 miles per hour. This is a simple method ; although not perfectly accurate in measuring the space traveled over, it is yet worthy of recollection by soldiers and travelers.

In judging the distances of objects by common observation, it has been ascertained that the movements of men can be seen at a distance of 2,600 feet, but neither the head, arms, nor limbs are distinguishable at that distance. At 1,300 feet each head becomes clear to the vision. A horse can be clearly distinguished at a distance of 4,000 feet, and a horse and his rider, as a moving body, at 1¾ miles. There is such a difference in what is called "the strength of vision," that scarcely six persons can be found in one company whose powers of sight are uniform. By measuring known distances, however, and viewing the appearance of objects at such distances, we can acquire, by this practice, great proficiency in estimating distances.

In appreciating distances by sound, it is already known that sound travels at the rate of 1,090 feet per second, in dry air at the freezing point, and 1¼ foot less for every degree above 32° Fah.—making it 1,058 at 60°. When we see the flash of a cannon or musket, and note the exact time, by a stop watch, of the interval that occurs until we hear the report, by multiplying this, in seconds, by 1,058, when the air is at 60°, we will obtain a tolerably accurate answer respecting the distance of the cannon or musket. The direction of the wind and its velocity modify the result; still, with a little practice and close observation, such as are acquired in the camp, we can approximate very closely to perfect accuracy.

To measure the distance of objects by angles, using a pencil or common foot rule (which most soldiers should carry with them), for this purpose, the accompanying illustration will serve to explain the princi-

ple. Prepare a scale on a common pencil and mark it off into spaces which cover a man of 5 feet 9 inches in hight, standing at 50, 100, 200, 300, and 400 yards distance, and so on, up to 1,200 yards, or a mile. Two men can, in this way, make a scale of distances in a very short space of time, the one acting as the object of measurement, the other marking the pencil. And when the pencil is thus graduated with a scale, any number can be copied from it.

The instrument is used as follows:—When a man is seen at an unknown distance, hold out the pencil at arm's length, with the top of it in line with the eye and the head of the object, then place the thumb nail at the line on the pencil which runs direct to the feet. The space on the pencil which covers the object will indicate its distance from the observer.

A foot rule is a very convenient device for measuring distances in this manner. Thus, if a foot rule is held out at 2 feet from the eye, and one inch of it covers a man 5 feet 9 inches high, he must be 138 feet distant. The arm must be kept very steady while thus endeavoring to ascertain the distance of objects. The average hight of men is 5 feet 8 inches ; a man on horseback is about 9 feet high.

All riflemen and artillerists should make themselves familiar with all the simple modes and devices for determining the distances of familiar objects, such as men, horses, tents, houses, trees, &c. The ramrods of cannon are frequently graduated with a scale, in the manner described for the pencil.

Device for Cleaning out Rifles, Muskets, &c.

The accompanying engraving represents a very simple device for cleaning out small fire-arms ; it was recently patented in England by Wm. Wilson, of London.

A flexible tube, *a*, of vulcanized india-rubber, is secured at one end to a sleeve, *b*, of brass, which fits on the nipple of the rifle or musket to be cleaned. Said sleeve is provided with a head on which the hammer

rests, and by these means the sleeve and the tube, *a*, are firmly retained on the nipple. A small piece of metal pipe, *c*, may be inserted into the opposite end of the india-rubber tube, to impart to the same the desired weight.

When it is desired to use this device, one end of the tube is secured to the nipple by means of the sleeve, *b*, and its other end is inserted into a vessel containing water. One end of the ramrod is now converted into a pump piston by wrapping around it a small quantity of oakum, and by moving this piston up and down in the barrel, the water from the vessel is alternately sucked in and forced out through the nipple, thereby cleaning the barrel rapidly.

Infectious Opthalmia—A Fact for Hospital Physicians.

A fact throwing considerable light on the propagation of contagious miasma has recently been made by Dr. Eiselt, of Prague. In the Foundling Hospital at Repy, out of 250 children, between the ages of 6 and 10 years, 92 cases of blennorrhœa of the ocular conjunctiva occurred. This epidemic opthalmia fully convinced Dr. Eiselt that the contagion was transmitted by other means than by contact. The doctor ordered the nurses to carefully avoid touching the eyes of the afflicted children, and he was no less careful himself ; but notwithstanding every precaution, both the doctor and the nurses were attacked with the disease. Dr. Eiselt then thought of examining the atmosphere of one of the wards of the hospital containing many patients, by means of an aeroscope, and in the first portion of air that passed into the instrument, he distinctly recognized small pus cells, which certainly served as vehicles of contagion.

The great importance of this discovery should induce physicians to give it a thorough investigation, so as to provide proper measures for preventing infection by this disease. Opthalmia oftentimes becomes a terrible plague in military hospitals during active warfare, especially in warm, dry climates, where the soil is light and sandy. The best preventive, we think, of the virus of opthalmia being transmitted through the atmosphere of hospitals is a free circulation of pure air, as this involves the quick removal of infected air.

India-Rubber Facing for Forts.

Messrs. Editors :—Please inform me, through the Scientific American, that if Fort Sumter had been covered on the outside with heavy sheets of india-rubber, say ten inches thick, could such covering protect the fort from the heavy shot and shell of the enemy? India-rubber will stop a locomotive at full speed, and might possibly stop a cannon ball.

If it is practicable, we can soon invent a very easy way to fasten it to forts or war vessels. Americans must invent an external covering for war vessels that will be lighter than iron ; we must have faster sailing vessels of war than the French iron-plated frigates, and be equally as well protected. No such word as "fail ;" we can do it if we try. Henry Fisher.

Alliance, Ohio, April 29, 1861.

[Experiments have been tried with india-rubber for covering vessels ; but it is impracticable, as it would require very great thickness to be effectual, and the material is very expensive.—Eds.

Campaigning Axioms.

We copy the following excellent suggestions from the New York *Tribune*:—

1. One well fed, well equipped, well appointed brigade is worth two that are ill provided.

2. In active service, three men die of undue exposure, bad food, and their own imprudences, where one is killed by shot or stab.

3. An easy, rational, nicely fitting uniform, with warm, substantial blanket, broad-soled boots or shoes and good woolen socks, will more conduce to efficiency in service than superiority in weapons.

4. The lightest possible head-covering, with a good look-out for ventilation, will add a tenth to the distance a regiment can march in a day, while insuring increased comfort.

5. A small cotton handkerchief, or half a yard of the commonest sheeting, moistened with water in the morning and again at noon, and worn between the hat and the head, will protect the soldier from the sun-stroke and greatly diminish the discomfort and fatigue of a hot day's march.

6. A flat bottle covered with woolen cloth, the cloth being moistened and the bottle filled with water in the morning, will keep reasonably cool throughout a long, hot day.

7. Of all villainous concoctions, the liquors sold by camp-followers are the most detestable and dangerous. They are more deadly than rifled cannon, and are sure to be taken just when they should not be. Every soldier who means to do his duty to his country should insist that all venders of these poisons be drummed out of camp.

8. A good cook to each company, who knows how to make salt meat juicy and tender, and to have it ready whenever and wherever it may be wanted, is equal to two doctors and four extra combatants.

9. Officers who love and care for their men while in repose never have to complain of their conduct when in action.

10. A soldier whose heart is in the cause he fights for is worth two who fight for their pay.

A Pertinent Question from an Inventor.

Messrs. Munn & Co.—My model is ready, and I wish to know if it is of any use to try to do anything under the present state of things.

I had my doubts about getting anything done with dispatch now, under the rather peculiar state of affairs at the seat of government. Please inform me at your earliest convenience, and oblige yours, truly, T. H R.

In answering the above, we reply to other letters of similar purport which have been lately received at this office. The city of Washington is now safe from attack by secessionists, beyond any question, and at the Patent Office, business is being transacted as usual, and the papers are transmitted to Washington by mail as safely as ever. Applications are acted upon with even less delay than usual, as the Examiners have less cases and therefore not so much to do.

It is stated, on the authority of both English and French experimenters, that the injection of air into the veins of the human or animal system causes instant and painless death.

The Amount of Lead Required to Kill a Soldier.—At the meeting on Monday, April 29th, at the Cooper Institute, Dr. Church addressed the audience upon the mortality incident to war. Disease and exposure constituted, he said, the great causes of death among soldiers. There had been obtained careful statistics at the Crimea and other places, of the amount of metal employed, and the number of the killed and wounded. The result was that they had ascertained, with wonderful mathematical certainty, that 270 lbs. of lead were shot away to every man that was killed. Prevention against disease, was, therefore, what the soldier chiefly needed.

Affairs at Harper's Ferry.—We are at last in possession of official details concerning the condition of affairs at Harper's Ferry, after the destruction of the armory by Lieutenant Jones. It seems that the work was by no means an entire success. The fire did not touch one large depot which contained 8,000 stand of first-class arms, and the entire machinery of the armory is in as good order to-day as it ever was. The Department attach no blame to Lieutenant Jones, thinking that he did the best he could under the circumstances.