The Cannon, the Steam Engine, Man, and the Insect Considered as Mechanical Motors.

Under the above title, we give a resumé of some very curious and interesting information published in a recent work of Mr. E. Jouffret, entitled "Introduction to the Theory of Energy."

These examples, which are submitted in a simple and clear way, are well calculated for disseminating a knowledge of the phenomena of conservation and transformation of energy, by presenting them under a concrete form accessible to all those who are not making a special and continued study of them.

A 100-ton cannon (Italian model of 1879) costs 400,000 francs. It requires a 250 kilogramme charge of powder, and throws a projectile weighing 917 kilogrammes, with an initial velocity, at the mouth of the cannon, of 523 meters per second.

The energy possessed by the projectile, in the form of live power, is 12,772,000 kilogrammeters.

The energy represented by one kilogramme of powder is, according to Noble and Abel, 300,000 kilogrammeters, or 75,000,000 kilogrammeters for the charge of 250 kilogrammes.

The *cannon*, considered as a machine, converts then into work *seventeen per cent* of the total energy of the combustion of the powder. This figure is higher than that furnished by the best steam engines, as these convert into work less than ten per cent of the total energy represented by the coal.

It is the animal machine in which the performance is the highest, and this fact may be established, in a particular case, as follows:

According to the *Guide Joanne*, the ascent of Mont Blanc, starting from Chamounix, is effected in seventeen hours, resting spells not included. The difference of level is 3,760 meters. A person ascending, who has a mean weight of 70 kilogrammes, produces, then, in order to rise, a work of $3,760 \times 70 = 263,000$ kilogrammeters. This work is borrowed from the heat that the carbon and hydrogen contained in the food eaten disengages upon being burned in the lungs. For the sake of simplicity, if we reduce the entire energy to a combustion of carbon, and recall that a kilogramme of the latter furnishes 3,000,000 kilogrammeters, we find that the 263,000 kilogrammeters represented by the ascent correspond to a consumption of 94 grammes of coal—a consumption that comes to be added to the normal rations necessary for the operation of the organs during a state of rest. Such consumption is 8·35 grammes per hour, or 142 grammes for the seventeen hours. The total consumption of coal is 256 grammes, representing 708,000 kilogrammeters. The performance, then, is

$$\frac{263,000}{708,000} = 37 \text{ per cent.}$$

The performance of the human machine drops to 21 per cent when we consider a period of twenty-four hours composed of ten hours of work and fourteen of rest, and a mean daily work of 280,000 kilogrammeters.

The cannon, considered as a machine, is incomparably superior to the steam engine as regards the time necessary to produce a given quantity of mechanical work.

Thus, for example, the 100 ton cannon develops in *one-hundredth of a second* a quantity of work equal to that which would be yielded by a 47-horse power steam engine *in one hour*. A man of average strength is still lighter than an ordinary steam engine of equal power, but he is much inferior to the other animals of creation, and particularly to insects.

Thus, for example, the libellula, which is capable, without apparent fatigue, of following a train of cars for several hours, giving its wings during this whole time some thousands of backward and forward motions per second, is a hundred times lighter than a steam engine capable of producing an equivalent work.

This is what renders the problem of aerial locomotion so difficult, and, as Mr. Hirn says, it explains why we can fly in imagination only.—*La Nature.*

Microscopic Examination of Water.

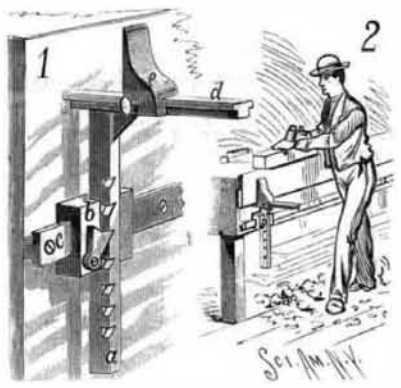
J. Brautlecht produces a precipitate in the water by adding to 100 c. c. 5 drops of a solution consisting of one part aluminum sulphate, one part hydrochloric acid, and eight parts water, followed up by one to three drops of liquid ammonia. The precipitate settles readily, and after decanting off the clear is collected upon a smooth filter, stroked off with a glass rod, and thus transferred to a test tube, in which it is dissolved in ten to fifteen drops of dilute acetic acid. The clear solution is examined with the microscope, at first alone, and then after the addition of a solution of saffranine. By adding one-half per cent of gelatine, permanent preparations may be obtained on Koch's principle.—*Rep. Anal. Chemie und Chem. Zeitung* (*Cothen*).

The Parasite of Malaria.

The observations of M. Richard seem to affirm those of Leverau; he found in the red corpuscles of the blood of persons suffering from acute malaria a parasite of oscillating form moving very rapidly, and sometimes disengaging itself from the globule. These parasites have been met with in a number sufficiently large to obstruct the capillary vessels, and to explain many of the symptoms of intermittent fevers. It has also been proved that the culture of these parasites in a fertile gelatine basis can be brought to an immediate cessation if a two per cent quinine solution is added.

STOCK REST.

A convenient, portable, and simple stock rest for the use of carpenters has recently been invented by Mr. James McVane, 2 Shawmut Place, Boston, Mass. The vertical main bar, *a*, is formed with a series of notches so that it may be held at any elevation by the pawl pivoted to the block, *b*, the bar sliding in the dovetailed groove in the block. The block is formed with a horizontal T-shaped groove which fits upon the guide rail, *c*, which is made in sections so as to be conveniently packed in a tool chest. The upper end of the vertical bar is provided with a cross head, *d*, that supports the timber being worked and that is made T-shaped in cross section in order to carry the dog, *e*, which holds the timber upon the cross head against lateral movement. A set screw holds the dog in place. The guide rail is secured to

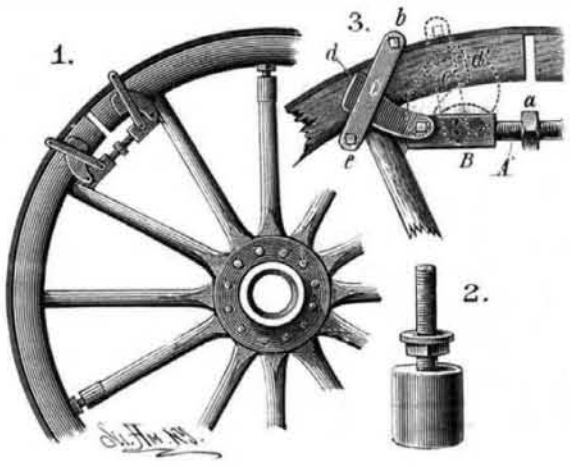


McVANE'S STOCK REST.

the side of the bench as shown. The block, *b*, and guide rail, *c*, may be made of cast iron and the other parts of malleable cast iron. Constructed in this manner it will readily be seen that the rest can be adapted to all the adjustments necessary, and the changes can be rapidly and easily effected. In addition it can be detached from the bench, taken apart, and packed in a small space in the tool chest.

FELLOE AND SPOKE TIGHTENER.

This invention provides means for tightening or taking up the play in felloes of wheels so as to avoid the necessity of resetting the tire in the ordinary way, and also provides for making the spokes fit tightly between the felloe and hub. There is a right and left threaded screw, represented at A, having an angular head, *a*, midway of its length, and upon the threaded ends screw two bars, B, provided respectively with right and left hand threads. The bars may be of iron and have the threads formed in them, or they may be of wood simply bored and provided with straps embracing two or more sides and having the threads formed in the portions which are at the inner ends of the bars. At *d* is shown a plate having its inner surface gouged out and serrated, and at one end provided with a slot to allow for adjustment in connecting the plate. Two of these plates are attached to the outer end of each bar, B, by a bolt and nut, thereby forming a pair of clamping jaws. A clamp-



GALBRAITH'S FELLOE AND SPOKE TIGHTENER.

ing bar having bolt holes at its ends is shown at *c* and *c'*. Two of these bars are attached to each bar, B, between the jaws and the inner end by a bolt, *e'*, and by aid of a bolt passing through the holes in the other ends forming a pair of clamping bars for holding the apparatus in place, as shown in Fig. 1. The bars are also intended for use to clamp across the ends of the clamping jaws, *d*, which are thereby held securely against the felloes when the tightener is to be used to draw the felloes together. The outer end of each bar, B, is provided with a cushion of some soft material in order that the surface may not be injured.

To use the apparatus the cushioned ends of the bars are placed against the spokes and felloes and the clamping jaws, *d*, arranged as in either Fig. 1 or 3. The bars, *c*, are then placed on each side of the felloe and over the jaws and secured by the bolts, *e* and *b*. The device can be arranged with the clamping jaws in the position most convenient, and the felloes can be tightened by either a drawing or pushing motion, as most desirable. The felloes are tightened by turning the screw, *a*, either in one direction or the other. When drawn together, the space between the felloe and tire is filled by thin perforated pieces of any suitable material put in with any cement or with barbed tacks to hold them in place. A hoop tapering toward the ends can be used. By turning the screw in the opposite direction the felloes are pushed away from each other, and the joints thus formed are filled with a suitable material.

The device obviates the necessity of leaving home to visit the smith, as one of ordinary ability can screw back the nut, put in the material, and screw up again. The exact amount of pressure needed can be put on each place, thus preventing dishing or straining. The felloes are not scorched so as to be in a condition to soak water. When not in use otherwise, the nut and right and left threaded screw bolts constitute a pressure jack.

The spoke tightening device shown in Fig. 2 consists of a cup made of suitable substance, covered to prevent it from chafing the wood, and of a size to fit over the end of a spoke. Extending through the cup is a screw bolt provided with a nut. The cup is applied to the end of the spoke, one end of the bolt entering the spoke and the other entering the hole in the felloe from which the spoke tenon has been removed. The felloes can be either drawn in or shoved out by turning the nut one way or the other. Instead of using a cup the bolt may be made as a cup to set over the spoke, and the nut is made with a flange having holes for screws by which the nut is held to the felloe. In case there is not room enough for the device between the spoke and felloe, the spoke may be cut off.

This invention has been patented by Mr. Archimedes Galbraith, of Amadore, Mich.

Polishing and Preserving Parquet Floors.

The finish and care of hardwood or parquet floors has been and is now a source of great trouble and annoyance to housekeepers, except in cases where the owners have taken the trouble themselves to look the matter up, or have instructed their architects to be particular about that item. It is too bad that where beautiful floors have been laid, in so many cases they have been left to be finished by persons who have not troubled themselves with finding out the best method of finishing. The usual way for such persons to do is to treat them with shellac or varnish, which is all wrong, as a moment's thought will convince any one that a surface that is constantly walked over needs something different to the coating of gum that is left on the surface after the spirit used in dissolving the shellac or varnish is evaporated.

This coating becomes, then, brittle, and is ground up into minute particles by the nails in the boots, and swept away, leaving the wood bare right where it is most exposed to view. As a matter of course, the beauty of the floor is soon gone, and instead of being an attractive part of the furnishing, the sanitary consideration very often is about all that keeps one from nailing a carpet over the whole floor. Others use linseed oil, and everybody knows that an oil finish is one of the best methods of finishing wood, but the objection to that method is that each time the oil is applied it darkens the wood, and in a short time the different kinds of wood are of the same color. Now the question arises, Which is the true and only way of finishing floors properly? and the answer is, by the use of hard wax, which, however, must be so prepared that the trouble of applying it, and the stickiness attending ordinary beeswax and turpentine, are entirely obviated. The wax is treated with special liquids and made into a preparation.

The writer has tried many things and found this hard wax to be the most satisfactory in its results. It is so simple, that when once the floor has been properly filled and finished with it, any servant can renew and keep the floors fresh and bright as long as the wood lasts, and it does not materially change the color—the wood always retains its beauty. An application about once a year is all that is necessary, if the floors are rubbed over, when a little dull, with a weighted brush or cloth. In repolishing old floors that have been in use for a length of time and become dull looking, it is only necessary after they have been cleaned to rub on a thin coat of the hard wax finish with the brush or cloth, as stated before. If the floors have been varnished and the varnish is worn off in places, as mentioned above, the best way is to have the varnish scraped off, and then a thin coat of the hard wax should be applied and treated as the new wood after it is filled. But if it is inconvenient to have the floor scraped, or the expense too much, the main object being to restore the color in those places which are worn and defaced, the following mixture is recommended: One part linseed oil, one part liquid drier, and two parts turpentine. A cloth should be dampened with this and applied to the worn and defaced places, which will have the desired effect. After being wiped off clean it ought to dry twenty-four hours, and then polished with the hard wax finish. It is very important never to use the wax over oil that is not thoroughly dry, as the floor would invariably be sticky. Finally, it would be well to mention that hard wood or parquet floors should never be washed with soap and water, as it raises the grain and discolors the wood.

After the floors have been properly filled and finished with the hard wax, dirt will not get into the pores, but stays on the surface, and consequently can be removed with a brush or cloth; or, if necessary, dampen cloth with a little turpentine. This will take off any stain from the finish.—*Decorator and Furnisher.*