

**The Rifle Balls of the Future.**

The reduction of the caliber of guns is necessarily accompanied with a diminution in the weight of the projectile. The length of the latter, in fact, cannot exceed a certain limit, beyond which it would no longer have sufficient stability in its trajectory. It would, therefore, be of considerable interest to have at our disposal, for the manufacture of rifle balls, a metal of reasonable price and heavier than lead. One of the metals upon which hopes may be founded, remarks the *Revue d'Armes Portatives et de Tir*, is tungsten. This metal, which is almost as hard as steel, has a density varying from 17 to 19.3, say one and a half times that of lead. By reason of such qualities, balls of tungsten, of equal dimensions, possess a power of penetration much greater than that of lead. Thus, a tungsten ball penetrates a steel plate 3 inches in thickness at a distance of 650 yards, while a similar one of lead penetrates a 2½ inch plate at 325 yards only. The present obstacle to the use of tungsten is its relatively high price, but there are indications that this will soon be lowered to reasonable figures.

**NEW TOOL SHARPENER.**

There is perhaps no better gauge of the ability of an artisan than the appearance of his tools after he has sharpened them.

Mechanics are not common who can sharpen a tool so as to give its smooth plane surfaces a correct angle and a clean edge. Recognizing this fact, Messrs. Ezra F. Bowman & Co., of Lancaster, Pa., have brought out a simple but effective device for holding tools of various kinds while being sharpened. This device, which is shown in the annexed engraving, consists of a yoke in which is journaled a roller designed to roll upon the surface of the stone on which the tool is to be sharpened, a post inserted in the yoke and capable of being adjusted to any desired angle, and a tool-hold-



GRAVER, DRILL AND TOOL SHARPENER.

ing clamp inserted in the end of the post and adjustable in a plane at right angles to the plane of rotation of the post. It will thus be seen that the tool may be readily adjusted to form any angle with the abrading surface. The milled nuts serve to clamp the parts in any desired position.

The collar on the tool clamp and the base of the post are graduated to permit of reproducing any particular adjustment.

While this tool is more especially designed for sharpening jewelers' and engravers' tools, it is applicable to other uses.

It is particularly useful in sharpening gravers of various kinds, flat and twist drills, and many other small tools which, without the aid of this instrument, can be sharpened only with considerable difficulty.

**The Phonograph in the Class Room.**

Professor McKendrick, of Glasgow University, carried out an interesting experiment in his physiology class one day recently. The occasion was the formal closing of the summer session, and the professor gave a practical demonstration of the ability of the phonograph to deliver the lecture which he had previously spoken into the instrument. The words were distinctly heard in every corner of the class room. Of late, suggests the *Christian Commonwealth*, such "demonstrations" on the part of noisy students have occurred and recurred in certain of the medical classes in the university that the suggestion to substitute the phonograph for the *personnel* of the lecturer may not seem altogether far fetched.

"HELLO! What do you want!" exclaimed a parrot the other day, when a robber entered an apartment house up town. The thief had adroitly seized some clothing and was making off with it when the voice of the bird called the occupant's attention to the intruder, who was quickly arrested and taken to the police station.

**Punches.**

A large number of tests of punches of different forms were recently made by Mr. George S. Allen. The object of the experiments was to determine: (1) Which of the various shaped punches now in common use for punching iron and steel did its work with the least maximum pressure and the relation of unit stress to distortion as the punch passed through the plate; (2) the effect of clearance upon the power required by the punch; and (3) the effect of the form of punch and the amount of clearance upon the tensile strength of the punched plate. The results of the test may be summarized as follows:

1. A punch to work easily and not injure the metal should not be cupped out.
2. A double punch, that is, one which first punches a small hole and then reams it out by means of a shearing counter-punch, leaves the plate stronger, but requires at least twice the power necessary to run a flat punch.
3. The ordinary flat punch leaves the plate about 90 per cent as strong as a drilled and reamed plate.
4. A milled spiral punch is preferable to one which has the spiral cut in a lathe.
5. A single spiral requires less pressure than a double one, and leaves the metal about as strong.
6. A single sloping or whistle-shaped punch does its work with the least consumption of energy.
7. Between the limits of 0.01 inch and 0.05 inch clearance has no effect on the power consumed by a punch or upon the strength of the punched plate.—*Engineering*.

**Tests of Bullet-Proof Clothing.**

An example of bullet-proof clothing, claimed to be equal to that of the famous German inventor, Herr Lowe, has been produced in this country. John F. Lennard is the inventor. An exhibition was recently given at the Imperial Music Hall, this city. Marksman Johnstone took his place on a platform in the center of the auditorium and fired at a corrugated steel plate with a Winchester rifle. Sixteen boards seven-eighths of an inch in thickness nailed together, with a seven-eighths of an inch space between each, were then placed before the steel plate. Two shots fired traversed the fourteen inches of pine wood and struck the plate.

Lennard, the inventor, then donned his bullet-proof shield, concave in shape. It covered less than a foot and a half square of his chest. With chalk a small bull's eye was made in the center. Johnstone aimed, and at the command of fire, given by Lennard, he discharged his rifle. Lennard trembled visibly as the bullet struck, but he was unhurt. As represented the act is certainly a remarkable one. Lennard declines to divulge the secret of his fabric. He asserts that, unlike Maxim's, there are no steel plates concealed in the shields, proof of which he will furnish by permitting their being tested by means of a brace and bit.

**How to Make Milk Sugar.**

Prof. C. L. Penny, of the Delaware Experiment Station, gives the following:

The skim milk is heated in a suitable wooden or tin tank to about 120 deg. F. To this, for each 100 pounds of milk, one and one-half pounds of sulphate of alumina is added in the form of a hot solution. The curd precipitates at once or in a very few minutes. The clear whey is then separated from the curd by filtering through wire gauze. It is next heated to not less than 180 deg. and about one-fourth pound of powdered chalk to each 100 pounds of milk is added. The excess of sulphate of alumina is precipitated, together with some nitrogenous matter in the whey not precipitated by the first treatment. From this precipitate a perfectly clear filtrate may be obtained, the large part by simply drawing off, the last portion by filtering through duck filters. This clear juice contains sugar, some sulphate of lime, and still a small residue of nitrogenous matter. . . . To prevent foaming, which would greatly retard the work or cause a loss of much of the sugar, a treatment with ground oak bark, or its extract, has been found thoroughly effective.

It is indeed believed to be, if not a necessary part of the process, at least one that will greatly facilitate it and diminish the loss. From three to four pounds of ground bark for every 100 pounds of milk is found to be enough. Instead of the ground bark, from two-fifths to one-half pound of commercial tanner's extract of oak bark is more convenient and equally sufficient. Bone-black also attains the same end, but it is not recommended on account of the time, trouble and expense of the treatment. The whey thus purified is boiled in a vacuum pan just as are sugar juices. The crude, almost black product is first boiled to prevent moulding and afterward purified by being redissolved, passed hot over bone-black till it is colorless, and again evaporated to the point of crystallization. The purified sugar must be dry to prevent moulding.

It is estimated that with this method about 65 per cent of the refined milk sugar in skim milk, or about 3¼ pounds of commercial milk sugar per 100 pounds

of skim milk, can be recovered at a cost of about 13 cents per pound, which might be reduced with experience. The price of milk sugar during the year (1891) is quoted at 24 cents. The profit from working 5,000 pounds of skim milk per day, with milk sugar at 20 cents per pound, is calculated at \$21.09; and with sugar at 15 cents, \$12.96.

It is also believed that with actual experience the yield could be increased and the cost diminished from the figures given above, which are intended for the simplest form of plant, just such as is actually necessary to the profitable conduct of the business on a fairly large scale. The estimates are intended to be entirely safe and to overrate the expense and understate the profit, rather than the reverse.—*Rural Pacific*.

**AN IMPROVED CHECK REIN SUPPORT.**

The combined check rein support and winker stay shown in the illustration has been patented by Mr. Joseph Carter, of Blyth, Ontario, Canada, the over-check bit being also shown by itself under the horse's head. This support for an overdraw check is designed to prevent the check rein from wearing or rubbing against the head of the horse, and the winker stay is so attached that the blinds or winkers may be readily adjusted at any desired angle to the animal's head. The support consists of a face cross bar of leather, or metal and leather, having felt on its inner side, and resting on the animal's face, where it is held by means of two side bars, preferably of spring steel, leather covered. The bars are curved so as not to touch the animal's face, and their upper ends are attached to the crown strap of the bridle, which may also be of felt or similar material on its under side. There are loops or sockets, each with friction rollers, on the side bars, through which pass the rearwardly extending members of the overdraw check, rendering it



CARTER'S CHECK REIN SUPPORT.

very sensitive to every movement of the horse's head. The winker stay consists of a rod with a shank adjustable by a set screw in a slideway in the central portion of the face bar, the rod having in its ends sockets in which the wires constituting the frames of the winkers are conveniently adjustable.

**Explosion of a Silvering Mixture.**

Sanderson Drury, a youth of 18, was nearly blinded recently by the explosion of a mixture of nitric acid and mercury. Drury had a brass watch chain, and he was anxious to turn it into silver. He learnt the secret how to do this from one of the itinerant lecturers who attend Shipley Market, and he paid a visit to a chemist and purchased a mixture of nitric acid and mercury, which was supplied to him in a bottle. He had not gone far from the shop when the bottle was blown to pieces, the glass and the acid striking Drury in the face. At first it was thought by bystanders that the youth was killed. They conveyed him to the hospital, where Dr. Foster found that there were serious injuries to the eyes and face. The usual remedies were applied and the patient is going on as well as can be expected, although he has not yet regained his eyesight.—*Yorkshire Evening Post*.

**Artificial Silk.**

The process of producing "artificial silk," invented by Dr. Lehner, was shown to a party of scientists, etc., at Bradford recently. Waste cotton, wool, jute, or other suitable material is reduced to an emulsion by means of a mixture of nitric and sulphuric acids, when it is formed into threads by forcing it through glass tubes of small bore, and is passed over a series of rollers and wound in the ordinary way on bobbins. Before the artificial silk is used in manufactures, or is sold, it is denitrated to destroy the explosive properties, and is also rendered unflammable, which will render it suitable for many purposes, especially as it is said to resemble real silk very closely.