Poisons on Fruit.

There has been much discussion of late concerning the danger of poisoning from eating fruit which has been sprayed with salts of copper or arsenic to destroy insects or fungi upon the plant.

It is stated that experiments have been carried on for two years at the Michigan Agricultural College with a view of finding out the truth in the matter.

The important question is, Do the poisons penetrate the skin of the fruit? The tests have shown that copper sulphate has passed into the body of the pear, though more of the solution remained upon the skin. If this peel is not a protection, what can be said of the thinner skins, like those of the plum, the cherry, berries, etc.? Dr. Kedzie, who made the analyses, says that horticulturists often use much larger quantities of the poisonous solutions than are necessary to destroy the life of the fungi; one-half or even a third of the quantity generally used would be enough.

It is not safe to eat fruit which has been sprayed with any poisonous salts, for while the poison received into the system from one pound might not be harmful, if no more were taken, repeating the doses may in time result in slow poisoning.

And how are people in the cities to know whether or not their fruit has been sprayed?

AN IMPROVED BOILER TUBE EXPANDER.

According to this improvement, a hub rotating on a tapering central mandrel carries small steel rollers which bear against the inner periphery of the tube, a stop collar arranged about the mandrel outside the hub bearing against the tube sheet and serving as a guide for the mandrel when rotated. The invention has been patented by Mr. Henry Strecker, of Marietta, Ohio. At three points on the periphery of the hub there are recesses cut through to the interior bore, and holding rectangular boxes open at the top and bottom, the boxes being of somewhat tapering form, and having outer faces smaller than the holes in the hub in which they play. The boxes are inserted from the interior bore, and projected outwardly, but by reason of their taper will not pass entirely through the holes, preventing them from ever falling through the hub away from the mandrel. In each of the boxes is loosely held a steel roller, the rollers rotating in contact with the inner periphery of the tube when the mandrel is turned, but without falling out, their outer faces bearing directly against the tube and their inner faces against the mandrel. The construction permits the largest possible opening in the hub, so that a maximum range of expanding movement for the rollers is obtained. A washer and nut on the small end of the mandrel prevents the hub and stop collar from slipping entirely off the mandrel when not in use.

STRECKER'S BOILER TUBE EXPANDER.

Coast Defense.*

Works of coast defense are required (1) to protect our cities from distant bombardment from the ocean; (2) to bar the passage of fleets through narrow channels leading to important places; (3) to forbid the occupation of harbors useful to an enemy; and (4) to co operate with naval coast defenders in closing wide entrances of value leading to important landlocked bays or sounds.

In selecting the position for the works, local topography often exerts a governing influence. The best conditions are where the ground rises some 100 to 200 feet above the water; where a wide development is offered to the land guns, and a contracted field of battle to the enemy; where the depth, tidal oscillation, and currents are moderate, thus permitting the use of submarine mines as an effective obstruction, and where the soil and sanitary conditions are suitable to the objects intended.

To forbid to an enemy the occupation of a harbor useful for his purposes is a simple operation. It only requires a few modern mortars in a battery suitably designed to facilitate accuracy of fire and well protected against the operations of landing parties.

In the matter of mortar or high-angled fire it is believed that American ideas are in advance of any existing European constructions, although indications are not lacking that the subject is now attracting serious attention abroad. We have adopted a single caliber, 12 inches, in order to secure sufficient weight in the projectile to insure deck penetration, and sufficient capacity for large charges of high explosives. Recent experiments at Sandy Hook, as well as reports from Europe, induce the belief that either of two varieties of high explosive may be safely used in charges as large as 100 pounds in high-angled fire, and that ranges of at least 5 miles may be employed with sufficient precision to render the service appalling to shipping. The greater the distance of the vessel from this kind of battery, the greater her danger if struck.

Rapid-fire guns, chiefly of 12 centimeters (4·72 inches) caliber, are favored for sweeping the mined fields and water approaches. They will be mounted on the balanced pillar principle, so that perfect concealment in pits will be practicable until they are brought into action.

Submarine mines will be used to obstruct the passage of vessels past the batteries. They will not be restricted to single lines, through which it is too easy to countermine, but will be distributed over considerable lengths of the channel where they can be covered by a heavy fire of flanking guns. The mines are of the electric type, exploded automatically at contact with the vessel or by judgment at the will of the operator. Ground mines of cast iron are preferred for shallow water, not exceeding 30 feet, and buoyant mines of steel, spherical in form, for deeper channels. The size of the latter is adjusted to furnish the requisite buoyancy, which varies with the depth and strength of the currents. Experience has shown that where the depth exceeds about 100 feet and the velocity of the current is over 7 feet per second, the size becomes too great to admit of successful working. Tidal oscillations greater than 10 feet introduce serious difficulties in obstructing a channel by mines, but it fortunately happens that at none of our important ports is this range exceeded. Where more than one passage exists, channels not needed for our vessels will be closed by self-acting mines dangerous alike to all comers. A pattern perfectly safe to plant, self-destructive if set adrift, and exceedingly difficult to remove has been adopted.

Firing mines by judgment meets with but little favor in our service. The destructive range increases even less rapidly than the square root of the charge, and unless wasteful quantities of the explosive are used, the difficulty of determining the exact relative position of the mine and the ship will lead to failures, especially in the case of buoyant mines which swing considerably with the tide. By night and in fogs a judgment system would be worthless. Hence many small charges well distributed and exploded automatically at the shock of the vessel are preferred. By the use of electricity as the igniting agent, such mines will be harmless to our own vessels. The usual charge for contact mines is 100 pounds, and explosive gelatine or dynamite No. 1 is preferred for service. The electric fuse contains 24 grains of mercuric fulminate, and is ignited by a current of half an ampere. Mines are usually designed to be spaced at 100 feet apart, thus allowing for moderate errors of planting, since they are not mutually destructive at distances of about 40 feet. A 500 pound countermine works no injury at a range of 80 feet. It is considered that a channel defended upon the system adopted cannot be traversed with impunity until cleared by the operations of the hostile fleet, and the extreme difficulty of effecting this object under the close fire of the land guns will render such obstructions far more formidable than any other kind now known.

Space is lacking to consider, except in a very general manner, the engineering details of the coast batteries now under construction to receive our modern armament. Magazine accommodation for 200 rounds, of which at least 100 rounds will be stored in the immediate vicinity of the pieces, is provided for all high power guns. Shells will be stored loaded, but without the fuses, and the propelling charges will be kept in service cartridge bags protected by waterproof zinc cases. No handling of loose powder will thus be needed in the magazines. This condition is demanded by reason of the immense amounts of powder required by modern high power guns. Thus for 200 rounds the amount called for by an eight inch gun is 13 tons; by a 10 inch gun, 25 tons; and by a 12 inch gun, 45 tons.

As no funds have thus far been made available for the construction of armored land defenses, no definite decision as to the kind of armor to be adopted has been made. The matter is held in reserve to benefit by the latest developments. It is hardly probable, however, that the immense expense of the new types of ship armor will be demanded, especially as on land weight is rather an advantage than otherwise.

The batteries under construction are protected by earth and concrete. With a view to deflecting the projectiles, and to reducing cost, as many bowlders or large masses of rock are incorporated in the latter as is consistent with the formation of a solid monolith. The rule has been adopted that the magazine cover on any probable path of a projectile fired from the larger high power guns should be 40 feet of such concrete and 10 feet of sand, or their equivalents—2 feet of sand being regarded as the equivalent of 1 foot of concrete. Near the surface the full thickness of concrete is used, and its exterior face is given a slope of 1 on 1 for the purpose of deflecting the shot. For parapets a breast height wall of 25 feet of concrete with exterior covering of earth sufficient to fill out to the plane of magazine cover is adopted. This total protection corresponds to a thickness of about 70 feet of sand.

The new system of coast defense is fairly inaugurated, and will be prosecuted as rapidly as Congress provides the funds. Mortar batteries are now under construction at both entrances to New York Harbor, at Boston, and at San Francisco. A gun lift battery for two 12 inch guns has been constructed and successfully tested at Sandy Hook. Disappearing gun batteries are completed or under construction at Portland, Boston, both entrances to New York Harbor, Washington, Hampton Roads, and San Francisco. Mining casemates are built with their cable galleries at all the most important harbors, and a fair supply of the mines and their accessories are in readiness for use.

*Abstracts from a paper by Brevet Brig. Gen. Henry L. Abbott, U. S. Army, Colonel, Corps of Engineers, read before the International Congress of Engineers at Chicago, and published in the *Journal* of the Military Service Institution of the United States, by permission of Major Clifton Comly, Chairman of the Division of Military Engineering.

RIGHTHANDEDNESS AND LEFTHANDEDNESS OF SIGHT.

Are you righthanded or lefthanded of sight? At present, in hunting and in pigeon shooting, good marksmen generally fire with both eyes open. How can they aim, that is to say, place the eyes, the two extremities of the barrel and the target upon the same straight line? It is possible to put the gun sight, the target, and a single one of the two eyes upon the same line; but to do this with both eyes is as difficult as it is to put the foot of the large arm of a cross and the two extremities of its small arms or the three angles of a triangle in a straight line. And yet these marksmen assure you that they aim with both eyes, and, in fact, at the moment of firing, they have both open; but they aim often with one eye only, without being aware of it.

In order to convince yourself of this, take a piece of paper or cardboard or a playing or visiting card, and, with a sharp pencil, make a hole in it of the diameter of the pencil. Place this card at 30, 40, or more centimeters from your eyes and at 10, 15, 20, or more from any point upon say a table or wall (Fig. 1). This point will represent the target, and the hole in the card will be the sight. With both eyes open, look at the point in placing the card, or rather the aperture, between such point and your eyes, and, while you hold it, first close one eye, and then open it and close the other without changing the position of the card. Now, you will at once perceive that you see the point sighted with but one of your eyes, unless the perforated card be shifted; that is to say, the aperture in the card and point sighted are in a straight line with but one of your eyes, without your in the least mistrusting it, since you sighted with both eyes open. The same thing happens to the marksman who aims with both eyes; one eye alone operates usefully for aiming.

Instead of performing this experiment with a perforated card, it can be made with the hand. To this effect, place the end of one of your fingers in a straight line with any more or less distant point and your eye, both eyes being open. Afterward close your eyes alternately, and you will become aware of this fact, viz., that with one of your eyes you will see your finger tip and the point that is sighted upon the same straight line, and that with the other there will be a wide space between such point and the extremity of your finger. Many of those who shoot with the two eyes open are excellent marksmen, and many of those who formerly closed one eye have changed system, having found that the advantages of this method are real. The object is seen better, the distance is calculated better, and, at the moment of pulling the trigger, one avoids the muscular effort necessary to close the eye, and which has required practice. Children do not succeed in it upon the first trial, and without grimaces. Many grown people cannot close a single one of their eyes or can close only one of them—the right or the left.

In England, as we know, where first-class marksmen are very numerous, and where guns of remarkable precision are made, gunsmiths are not ignorant of the fact that the marksmen who aim with both eyes open make use effectively of but one eye for pointing; but they have, it appears, observed that this eye in some is the right one and in some others the left; that is to say, there is righthandedness and lefthandedness for the sight as well as for the hands. We say here *for the sight*, as we do not intend to speak of those who cannot close the right eye or the left eye, or of those who are blind in one eye or the other, or of those whose right eye or left eye sees objects more distinctly than its mate.

Those who are blind in the right eye might, if need be, shoulder to the left or slightly modify the position of the head or weapon. Still, no one is ignorant of the fact that there exist special guns for those who are

blind in this eye and who wish to shoulder to the right like every one else, without in anywise changing the ordinary position of the body (Fig. 2). In such guns the axes of the breech and barrel are in two different parallel planes, in order that the barrel and the lefteye may be easily placed upon the same line, while the back of the weapon is to the right. The difference that separates these two planes is that which exists between the centers of the right and left eye.

One may deduce from this fact how important it is to a gunsmith who is to construct a weapon of value for a marksman who aims with both eyes open, to know whether his customer's sight is righthanded or

Fig. 1.—EXPERIMENT TO SHOW WHETHER A PERSON'S SIGHT IS RIGHT OR LEFT HANDED.

lefthanded, just as it is important, before placing him upon a railway, to know whether the engineer of a locomotive, who, by his calling, ought to distinguish red and green, is or is not affected with daltonism. The majority of men do not confound these two colors, and so, too, almost all hunters have righthanded sight, but in both cases it is prudent and wise to know positively what to depend upon. So good gunsmiths, it seems, submit the person who orders a gun of them upon measurement to a careful examination, in order that the weapon may be as well adapted as possible to the proportions and habitudes of the future owner, and they do not neglect to ascertain whether the marksman's sight is lefthanded or righthanded, a circumstance of which he is generally ignorant. For such verification they employ the perforated card that we mentioned at the beginning of this article.

Do these gunsmiths obtain other information from such experiment? We do not know. The object of this article is not a study (which, however, would be interesting) of the advantages and inconveniences of firing with one or both eyes open with sporting guns or weapons of war. We shall add solely, apropos of this, that an old soldier has assured us that he has spent several days in the guard house because he did not succeed in closing the left eye at the moment of taking aim. This fact assuredly should not be isolated, and I follow it up now to ask whether it would not be more rational to teach sharpshooters to take aim, like many of the best civil marksmen, with both eyes open—a method that would cause the avoidance by soldiers of efforts, grimaces and perhaps punishment, even.

Moreover, marksmen are not the only ones who, having to make use of a single eye at a time, operate with both eyes open and even for very delicate work. Watchmakers and others who have made continuous use of the simple or compound microscope finally no longer close the eye with which they are not looking, and this, without causing any inconvenience, does away with certain useless effort and fatigue. Have such questions already been treated of in special works on hunting and shooting or in treatises on optics and ophthalmology? We do not know. It was but a short time ago that we were ignorant of the facts of which we have just spoken, and, in our turn, we point them out to the numerous persons who have never asked themselves how it is possible that one can succeed in aiming well with both eyes open.

We believe, then, that it may be established without fear of error (1) that it is possible to use consciously or instinctively a single eye while both eyes are open, and that such eye may be either the right or the left; (2) that there is a righthandedness and lefthandedness of sight; (3) that a person may not know whether his sight is right or left handed; and (4) that the eye upon which the attention and will is fixed—in other words, the one with which a person looks—is the one with which he sees, even when both are open. This latter fact finds a confirmation in the workers with the microscope of whom we have above spoken; and we have verified it by the following easily tried experiment:

Place in front of your eyes two paper or cardboard tubes from 3 to 4 centimeters in diameter, and hold them as you would an opera or field glass, but in such a way that they shall form with each other an angle of say 20° or 30°, as shown in Fig. 3. Direct the two tubes at two points, say two open books or the two somewhat widely spaced columns of a newspaper situated at a few centimeters from the extremities of the tubes that would carry the objectives if they were telescopes. You will then observe that it is very easy and in nowise fatiguing to read with the eye to which you give your attention, while the other sees nothing, although it remains open, and it is of little consequence whether it be the right or the left.

If, at the moment in which one of your eyes is reading or looking, you remove the tube that corresponds to the one that is not looking, you will continue to see only with the eye that is looking, although the other be open. This is the case with workers with the microscope.

The sight is an admirable faculty that focuses or regulates itself without the aid of our will, according as the object to be seen is more or less distant, and according as it operates in a dark or highly illuminated medium, but it may make use of but one of the two windows at its disposal, according to the requirements of vision. These operations of the sight are effected without our being able to suspect them.

Philosophers have discussed (and what have they not discussed?) whether there are things absolutely indifferent. Newton, we believe, thought that there were things indifferent even to the Creator. The universe, said he, had to revolve to the right or to the left. Now, at the moment of the creation it was indifferent to God whether his work began to turn toward one or the other of these two sides.

It has also been asked whether the preferred use of the right hand and the right side is innate, spontaneous, or whether it is the result of atavism and education; and, to look at things merely superficially, it would seem as if one might find some argument or other for this question in the fact of the greater or less number of cases of righthandedness or lefthandedness of sight. It would seem, in fact, as if the sight has not undergone the influence of education, in a large number of individuals at least, since they do not know even whether they are right or left handed.

But, in a closer examination, we observe that the influence of the hand over the eye or of the eye over the hand had to exist, and that it is not easy to establish in a peremptory and convincing manner where the primordial influence is found—whether it is in the eye or in the hand.

As for us, we are led to believe that there are more right than left handednesses of sight, because the right eye has undergone the influence of the secular education of the right hand and right side. We observe, in fact, that, for centuries, marksmen, for example, have been taught to assume attitudes in which this side has the most important role. Weapons have changed, but the position of the body has been preserved through the ages.

In shooting, the left arm serves only as a support; it is the right that bends the bow and sets free the string and arrow, and it is that, too, that pulls the trigger of the crossbow or gun while the head inclines to the right and one sights with the right eye. The same is the case with taking aim with a stone. The man or child raises the projectile to the height of the eyes, bends his head slightly to the right, places the right eye, the right hand and the object at which he is going to fire the stone upon the same line, after moving his left arm to the rear. The left arm plays a role, but an instinctive one, of counterbalance, of counterpoise.

But, again, is it the right hand that obeys the right eye or *vice versa*? Does the right hand owe its advantages to education and atavism, or is it rather trained

Fig. 3.—READING AT WILL WITH THE RIGHT OR LEFT EYE, BOTH EYES BEING OPEN.

unconsciously by the greater innate aptitude of the right eye for seeing, sighting and fixing? Then, it would be the sight that has commanded the position of the body and hand in the cases that we have just mentioned.

We shall terminate this article with a few statistics. Out of twenty or twenty-five persons, we have found two who had lefthanded sight—a lady who, nevertheless, was capable of handling a sporting rifle and who used it in closing the left eye for aiming, and a short-sighted monk. After explaining to the latter what it was a question of, we asked him if he thought his sight was right or left handed. He answered: "Right-handed, assuredly, since I see better with the right eye than with the left." The experiment with the perforated card proved to us that he was deceived.

Have lefthanded persons lefthanded sight, also? Are they lefthanded in the two organs in the same numerical proportion as righthanded persons? The experiment is easily made, but we have not attempted it, for want of subjects.—*La Nature.*

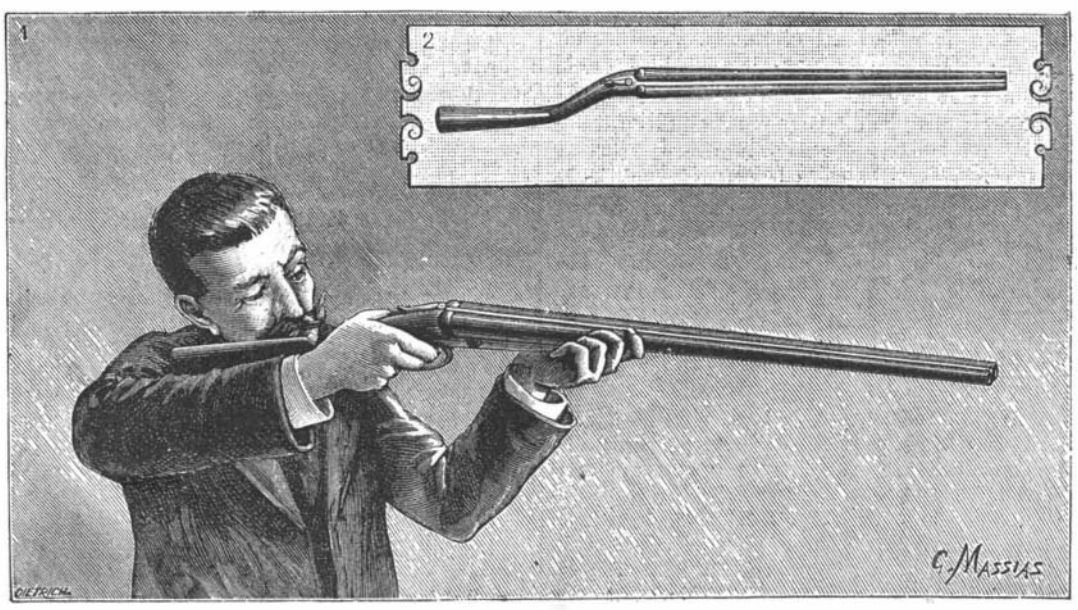

Fig. 2.—1. MARKSMAN SHOULDERING TO THE RIGHT AND TAKING SIGHT WITH THE LEFT EYE. 2. SPECIAL GUN FOR THOSE WHOSE SIGHT IS LEFTHANDED.

Experiments in Freezing Alcohol.

The success attending Prof. Dewar's experiments in the freezing of absolute alcohol has a peculiar interest, in view of the fact that 200° C. was the utmost limit of cold reached or obtained by man, viz., by the use of liquid oxygen. Prof. Dewar allowed some liquid ethylene to flow through a brass tube surrounded by solid carbonic acid and ether, and, when this cooled, it was passed into a large test tube, in the middle of which was placed a glass tube, with a flattened bulb at the end, the bulb being full of absolute alcohol. The evaporation of the ethylene was then accelerated by the use of the air pump, and the alcohol was frozen into a mass as clear and transparent as crystal. The tube containing it was turned bottom upward, and as it melted it assumed exactly the consistence of glycerine, flowing in a sluggish way down the sides of the tube. Ether requires less cold than alcohol to freeze it, and in several of Prof. Dewar's experiments ether ice formed on the sides of the glass vessels. Besides this, the warm air of the theater was constantly condensing as snow or hoar frost on some of the vessels used in the experiments, and the chief difficulty of the occasion was the projecting of the experiments on the screen by the electric light, so that all present might see what was taking place.

WITH an opera glass Gale's comet may be seen about May 10 in the constellation of Leo Minor, just above the Sickle.