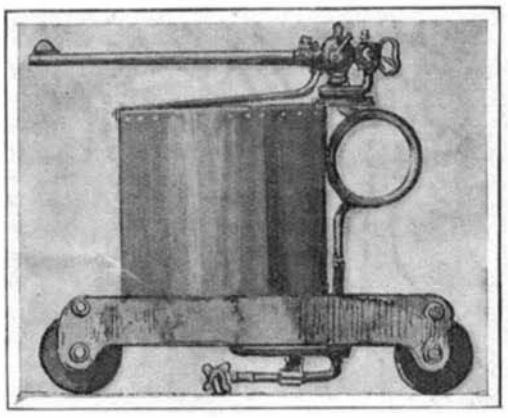
WEAPONS WEIRD AND WONDERFUL.

BY LIEUT.-COL. C. FIELD.

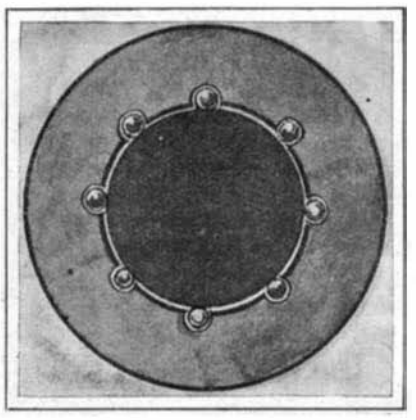
"And he made in Jerusalem engines, invented by cunning men, to be on the towers and upon the bulwarks, to shoot arrows and great stones withal."

This text, in the Second Book of Chronicles, is perhaps the first mention of the invention of warlike instruments. It was evidently a notable event, for the writer goes on to say of Uzziah, King of Judah, who is referred to by the pronoun "he," that "his name spread far abroad." Since those days the ingenuity of man has been taxed to the utmost to contrive new and more deadly means of killing and wounding his fellow men, and science has now brought our modern weapons to such perfection that it seems almost impossible to imagine any advance in their effectiveness. If we except the cold steel—which still has its uses, if we are to judge by the recent war in the East—there are

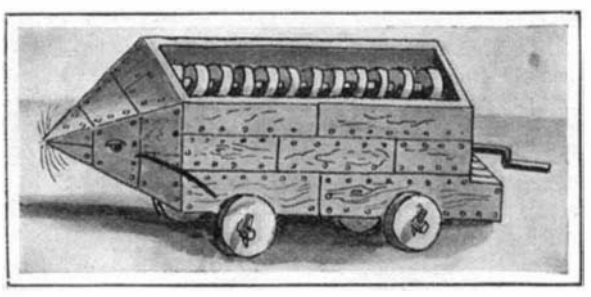


Sturgeon's Compressed-Air Gun (1888).

The Reservoir Helmet.



Cross Section of Ball-Bearing Gun. The Central Disk is the Shot.



The Musculus.

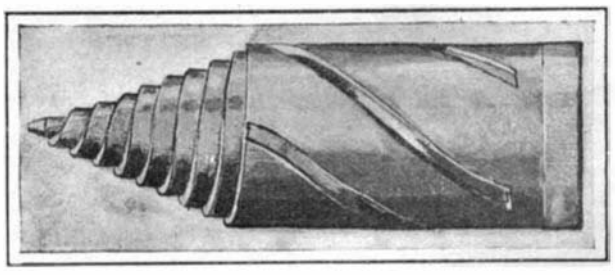
but three classes of offensive weapons—the gun and its projectiles, the rifle, and the mine or torpedo. In the process of their evolution from the stone and club of our prehistoric ancestors and the "engines" of King Uzziah, an enormous number of contrivances have been invented by the fertile brains of soldiers, mechanics, and scientists. Some of these, such as the "hand gonne," Edward III.'s "crakeys of war"—the cannon he took against the Scots—and the engineer Giannibelli's "devil-ships of Antwerp," may be regarded as being the direct ancestors of the rifle, gun, and torpedo of to-day. But there have been hosts of others, which have either become entirely obsolete after a very short reign, have never "caught on," or, in very many cases, have never had any actual existence outside the plans and ideas of their sanguine inventors.

Many of these warlike appliances, especially those belonging to the middle ages, are of the most grotesque description. As at no distant date the making of hideous grimaces to strike terror into the heart of an enemy was cultivated as a branch of the military art by the troops of the Celestial Empire, so in medieval times the grotesque seems to have been considered at least as much a desideratum as the practical by the inventors of offensive and defensive weapons. So we have such extraordinary contrivances as the "machine to break the ranks of an enemy" and the other dragon-like edifice here illustrated. How the former—which appears to be a kind of medieval motor car—got over the ground, and how it brought its formidable array of spikes to bear upon those who had the hardihood to oppose its progress, must be left to the imagination. The other machine is merely a grotesque edition of the movable towers that played such an important part in the sieges of ancient and medieval cities. The one touch of progress is the cannon projecting from the wicker monster's mouth. Ancient warriors had a great penchant for naming their various warlike engines and machines after animals, real or imaginary. Thus we have the Roman "musculus," or "little mouse," a machine for undermining the walls of a besieged city, the battering ram, the sow, the scorpion for discharging big arrows from a powerful bow, the onager for hurling stones. The onager, according to tradition, was an animal that had a pleasant trick of kicking stones with great violence at its pursuers. Again, the Roman warships were equipped with a spiked gangway known as a "corvus," or "crow," which on being let fall upon an enemy's ship, grappled her and formed a bridge for boarders.

Medieval soldiers made frequent use of the "wolf" in the defense of castles and towns. This was a species of huge harrow, made of balks of timber with wooden spikes at the intersections, which set up outside the walls could be thrown down and forward to crush the besiegers as they crowded to the assault. When cannon were invented, their names became legion. A ship or a train of artillery contained a perfect zoological garden of birds, beasts, and fabulous animals. There were basilisks, drakes, dragons volant, falcons, serpents, and pelicans, not to mention "double dogs" and partridge mortars. Nowadays our bluejackets, at any rate, prefer to call their pieces "Joe Chamberlains" and "Bloody Marys."

We have of late years seen a good deal in the newspapers about the training of dogs for military purposes, such as scouting, giving notice of the approach of an enemy, and searching for the wounded. In former days this intelligent animal was also employed in warfare, not only as a watch dog. One method of "letting slip the dogs of war" was to equip them with a pot of blazing resin, a collar of spikes, and a jacket of leather scales to protect their backs from the fire, and send them among cavalry, much to the fright and confusion of the horses. An Arab writer describes some wonderful war dogs which belonged to the Grand Seignior, which he says were as big as donkeys, were clad in rich cloth, silver collars and neck rings, and a circle of iron points around the neck. Some were even clad in armor. They were equal to tackling wolves, dragons in the fire, eagles in the air, and crocodiles in the water, to say nothing of being able to bring down a man from horseback, "however stout a fellow he may be." Dogs equipped in much the same manner were also used for incendiary purposes to set villages and houses on fire, as were also cats and pigeons. Even torches for this purpose were sometimes made in the form of dragons, as will be seen by the annexed illustration, taken from an old manuscript, of a date earlier than the Conquest. This mythical beast, being supposed to breathe fire and brimstone, was of course a very appropriate animal to choose as a model.

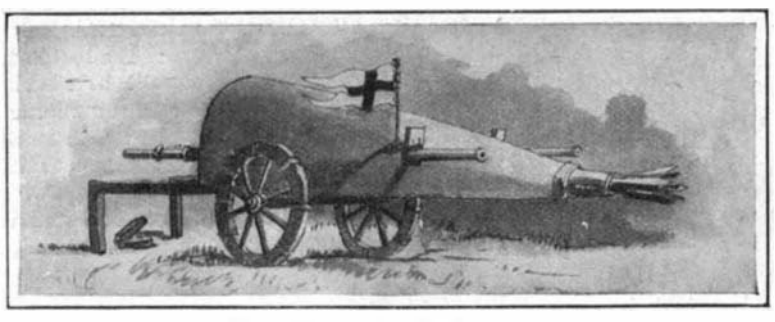
With the advent of artillery and firearms, all kinds of queer weapons were from time to time invented. Many of them distinctly foreshadowed our modern repeating and rifled weapons. Not a few revolvers, repeaters, and rifled muskets were made in the six-



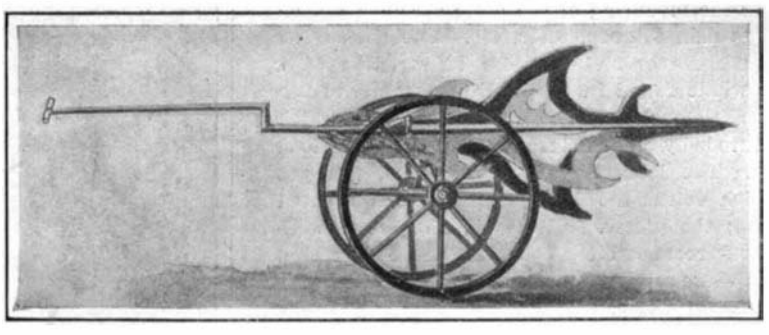
Armor-Piercing Projectile (1888).

teenth and seventeenth centuries, but as the whole affair had to be made by hand, their cost precluded any general adoption of these ingenious devices. The earliest cannon were breech-loaders, and like our modern guns were built up rather than cast. But even after the invention of cast iron and brass cannon, the smaller pieces were generally made to load at the breech. Here are a couple of such weapons mounted in a kind of cart. These were used by Henry VIII. against the Scots, and would appear to have been quite practical little affairs. They evidently could be wheeled like hand-barrows; the sloping shield would afford excellent protection to the gunners, and probably contained a receptacle for ammunition. The flag and bundle of spearheads strike us as being somewhat superfluous. War carts or chariots were not unusual at this time, especially in Germany. They generally took the form of a rude machine gun, several musket barrels being placed together in the center, and a great array of curly, murderous-looking spears and halberds arranged on either side. The Lyoners is a later type without musket barrels and intended for blocking a narrow passage. Sometimes a whole sheaf of musket barrels were fixed upon a stand or carriage. These contrivances were called orgues, from their resemblance to the pipes of an organ, or sometimes thunder carriages.

Monster cannon were an early form of extravaganza in military weapons. There are several accounts of such pieces of ordnance. A traveler in 1743 stated that he had seen at Brunswick a gun or rather mortar cast in 1411. It was made of brass, was 10 feet 6 inches long and no less than 9 feet 2 inches in diameter, and was said to be capable of throwing a 1,000-pound shell. India boasted several of these monstrosities. One still to be seen at Kubberpore is said to be no less than 21 feet 3 inches long and 5 feet 6 inches round the muzzle. It is called "Jaun Kushall," or destroyer of life, by the natives, and was probably cast somewhere

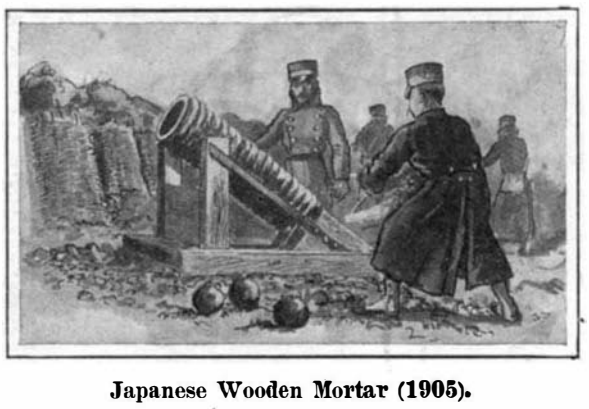


War Cart (16th Century.)



The "Lyoners" for Blocking a Lane.

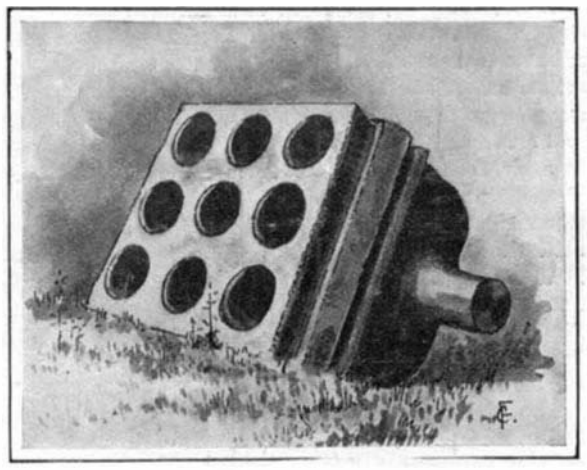
Pistolet à Reveil.



Japanese Wooden Mortar (1905).

in Persia. Another Indian piece, cast by Chuleby Koomy, Kahn of Ahmednuggeer, about the year 1500, has such a tremendous bore that the interior is now fitted up as a kind of summer house. A cannon made at Bruges in 1346 had a square bore and fired cubical shot. Guns were made of all kinds of materials, though all such may be regarded as freaks or experiments. The leather guns invented by an officer in the army of Gustavus Adolphus had a certain vogue on account of their lightness. Some were effectively used against us by the Scots under Gen. Leslie at the battle of Newburn Ford in 1640. They were made by wrapping rope and twine round copper cylinders strengthened by iron rings. They were then coated with plaster, and finally covered with leather. They were very portable, but unreliable and short-lived. Guns have been made of wood hooped with iron, not only in ancient times, but quite recently in the Philippines, where they were used against the American troops. The Chinese had a gun made of bamboo in 1259, but only the other day the Japanese were making effective use of wooden mortars bound round with bamboo for throwing explosives into the Russian works at the siege of Port Arthur. Guns have been made of glass, and even of ice. Some of the latter, made for saluting purposes at the marriage of the Russian Prince Gallitzi in 1739, are stated to have been "fired more than once without bursting." Guns have even been made of the precious metals. In 1663 there was in the arsenal of Verona "a great gun found in Candia, all of gold and silver." A golden cannon was captured at Peking in 1860, and King Thebaw of Burma was the possessor of another, which was also incrusted with precious stones. This is the kind of weapon one would like to have a hand in capturing. The early caliver was little inferior to a cannon in clumsiness, as it took three men to carry it and a fourth to fire it. When firearms became somewhat more portable, and especially when pistols were introduced, we find them mounted in the most extraordinary fashions. Shields or targets not infrequently had a pistol fixed in the center with a small grating for aiming through, but there is an account of a shield at Genoa which had no less than 120 pistols connected with it. Rather a heavy affair to handle, one would imagine. The Emperor Charles V. had a curious shield, which he carried when walking about at night; "a spear came out of the side of it, besides that in the middle; if any thrust was made at the shield, the sword's point was catched in it and broken." A target "made in Germany" had an extension reaching to the elbow, and a dark lantern affixed to the outside, a somewhat similar idea to that patented by an American two or three years ago. This is a revolver having a tube underneath the barrel, containing a small electric light. On beginning to press the trigger the light is switched on, dazzling the "enterprising burglar," and enabling the householder to select a point to aim at. Another surprising mediæval contrivance was an iron hat or helmet, which is described as having "two crowns, each with four pistols." A volley of eight shots from an opponent's headpiece must have been very disconcerting—probably to all parties concerned. A curious mortar in the Tower of London is square in front and has no less than nine separate bores. The eighteenth century was distinctly the epoch of sieges. The attack and defense of carefully-fortified places was carried out in the most methodical and patient manner. Who does not remember the prolonged discussions between Uncle Toby and Corporal Trim about the siege of Namur? Do they not remind us of a discussion between whist players? Everything was done by rule. Naturally, there were many inventions at that time specially applicable to the attack and defense of fortified towns. The petard was much used. It consisted of a bell-shaped iron receptacle filled with powder, and clamped down to a block of hard wood. It was intended to be fixed to doors and gates for the purpose of blowing them in. The accompanying reproduction of an old print shows the way in which this was done. The figure in the foreground looks as if he might very shortly be "the engineer hoist by his own petard," immortalized by Shakespeare. Another device was the "pot-à-feu," or fire pot, which was a kind of ball or globular jar filled with old tarred rope, which was thrown upon the enemy's works, to light them up at night and enable fire to be directed upon them. Loaded pistol barrels were attached to these, to prevent anyone from picking them up and extinguishing them. The "pistol à reveille" could be set to explode a mine at a given hour. But all said and done, we need not dive into the past to find extraordinary ideas and weird warlike appliances. Our modern inventors are quite capable of keeping up the supply. Leaving aside the steam guns, which were intended to spurt out streams of bullets after the fashion of a Maxim gun, which were invented by Perkins in 1824, by Winans in the sixties, and the very similar compressed-air gun patented by one Sturgeon in 1887, none of which realized its inventor's expectations, we can find plenty of extraordinary contrivances. The wire bullet-proof screen, behind which the soldier advancing to the attack defies any projectile smaller than a three-pounder, is as far-fetched an idea as anything produced in the middle ages. The reservoir helmet, a French scheme, is about as quaint as anything we have noticed. The lower part of this eccentric headpiece forms a species of tank or reservoir, into which the water (and pipe clay?) drains from the upper surface of the helmet. The soldier's head is therefore kept cool in the tropics—though the weight may perhaps be rather trying—and when a-thirst all he has to do is to remove his helmet and fill his cup from the tap at the back. This has not hitherto "caught on." It is just possible, though not probable, that the Russians might have found the revolving shield illustrated an efficient defense against the bullets of the Japanese. It is not easy to see how it would compare favorably either in weight or portability with an ordinary steel bullet-proof shield. This egregious apparatus consists of a pillar or standard, on which is mounted a set of fans or sails, which are revolved at a terrific speed by a small motor actuated by a portable battery. After switching this on, all bullets which might have otherwise found a billet in the soldier crouching behind this catherine wheel, are struck and deflected elsewhere by the rapidly-revolving blades or fans.

One of the most important qualifications of a good soldier is to be able to march well, but it is doubtful



Curious Mortar Now in the Tower of London.

Dragon Incendiary Torch (9th Century).

Wire Netting, Bullet-Proof Shield.

The Electric Fan Shield (1903).

Machine to Break the Ranks of the Enemy.

Spring-Heeled Jacques.

A Dragon for Attacking Towns.

WEAPONS WEIRD AND WONDERFUL.

whether the wearing of a pair of spring-soled boots, such as a recent inventor has suggested, would add many miles to the day's march. These "seven league boots" have an outer sole, which is pivoted to the one made on the boot just below the ball of the foot. A strong spiral spring is fitted between the two at the heel. To see a whole regiment charging a position wearing these boots, and bounding over the ground like kangaroos or wallabys, would indeed be a remarkable sight. The boring projectile here illustrated appears a somewhat more plausible creation, but the inventor can have very little realized the immense force and velocity with which modern projectiles strike their objective. Imagine a shot weighing over 800 pounds traveling over 2,000 feet a second, and striking with an energy of thousands of tons to the square foot, pausing in its career to carry out the comparatively slow process of boring through an armor plate like a gimlet! The Cullen ball-bearing gun is another extraordinary attempt to improve modern artillery. The sketch of its cross section will enable the reader to understand the idea, which, put shortly, is to substitute for the ordinary grooves of a rifled gun, through which the soft metal of the diving band has to cut its way and so give a rotatory motion to the projectile, a series of spiral rows of steel balls. These lie in grooves of a circular section cut in the sides of the bore of the gun, into which about one-twentieth of their diameter projects, so that while a spiral motion is given to the projectile, its progress is not retarded by friction, but rather accelerated. How the inventor is going to prevent the waste products of the combustion of the propelling charge from being driven into the interstices between the steel balls and jamming them all together, so that they revolve with difficulty, does not appear. The absurdity of the scheme was exposed by the SCIENTIFIC AMERICAN several years ago. Another remarkable invention, which like the preceding one, by the way, hails from America, is a cannon that takes completely to pieces. It consists of a series of strong steel disks which fit over the inner tube, which is, of course, rifled internally. Externally it tapers slightly, so that it is bigger and thicker at the breech end. The disks slide down on this tube in their proper order, the central ones having projections to form the trunnions of the piece, and are screwed tight up by means of four rods and nuts fitting into a massive framework at either end of the gun. The rear one of these carries the breech-closing mechanism. Invisibility has been pretty well secured by the invention of smokeless powder, and now inventors are trying to do away with the noise of the explosion into the bargain. This was effected in ancient days, according to an Arab writer, by the "powder which explodes without sound," made at El Meidaun, the ashes of human bones taking the place of charcoal. The making of this propellent is now, at any rate, a lost art, but the same object is, to a certain extent, attained in other ways. Col. Humbert, of the French army, has invented a species of tube which, affixed to the muzzle of a field piece, prevents either flash or sound, while a rifle invented in America has a big cartridge containing water, which interposes between the bullet and the powder charge in its base. This is supposed to regulate the escape of the powder gas, and so minimize the report without diminishing the force and velocity with which the projectile leaves the barrel. The great addition which this system would make to the weight of the ammunition is quite enough to put the weapon out of court for military purposes.

With this quite recent triumph of impracticable invention we must bring our short review of extraordinary military contrivances to a close. Myriads of other warlike "freaks" might be cited, but we have quoted enough to make it obvious that, as far as they are concerned, the process of "beating our swords into plowshares" might begin without in any way bringing in the epoch of universal peace. The practical weapons that would remain are amply sufficient to provide "battle, murder, and sudden death" for many centuries to come.

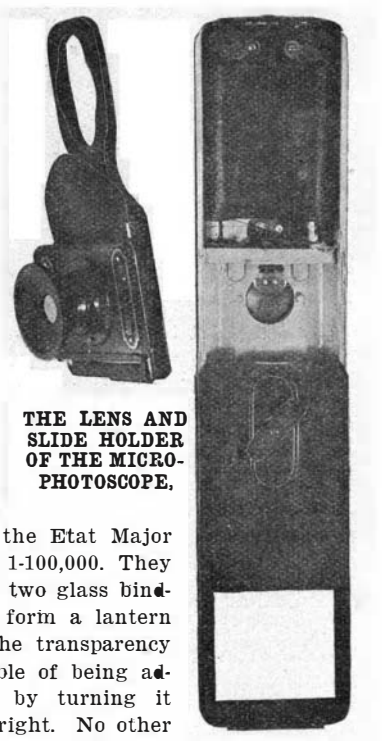
Beans are at present cleaned by hand work, which is not only slow, but unsatisfactory. The beans are scattered on a belt which passes before a row of girls, and stones, dirt, and other objectionable particles are picked out. In this way the cleaning capacity of each girl is between three and five bushels per hour. A machine for this purpose has been recently invented by Robert A. Little, of Lockport, N. Y., which performs the operation in a much superior and more economical manner. In this process the beans fall from a height into a shaking hopper, and here the chaff and lighter material are removed, after which the mass is transferred to a belt, where the foreign particles are carried one way and the whole and perfect beans are diverted to a compartment, where they are subjected to the action of an air blast. This not only removes all trace of dust and dirt, but gives the beans a high polish, which improves their selling qualities.

THE MICROPHOTOSCOPE—AN APPARATUS FOR EXAMINING MINUTE MAPS.

BY DR. ALFRED GRADENWITZ.

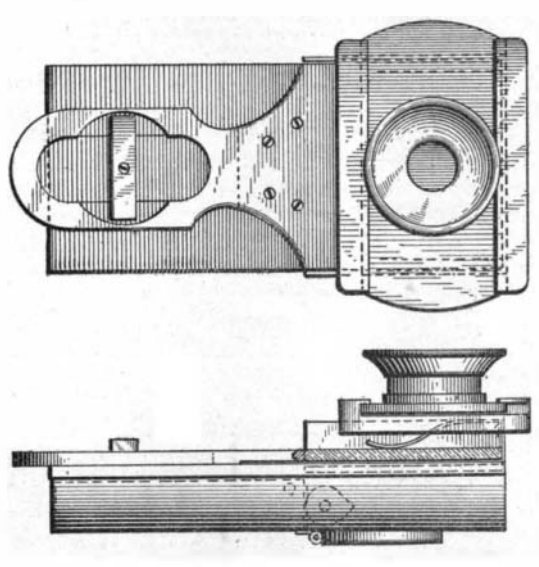
The importance of an efficient intelligence service in time of war will be readily appreciated by anybody. The most important element in similar service is a suitable stock of reliable maps, but even in case first-class maps are available, many drawbacks will be experienced, especially at night and during storms and rain, in using ordinary maps of the Etat Major; and the same may be said of maps intended for the use of tourists and sportsmen. The folding of large maps is moreover extremely inconvenient, and results in a rapid wear and tear of the same.

A very suitable device to obviate the above inconveniences has been invented by Dr. Otto H. F. Vollbehr, of Halensee-Berlin, in the shape of the microphotoscope. Though not doing away entirely with the necessity of ordinary maps, this device will afford a most welcome complement to them. With this aid microscopic transparencies 4 x 5 centimeters (1.574x1.968 inches) in size are used in place of large maps. These represent a map of the Etat Major drawn to the scale of 1-100,000. They are inserted between two glass binding plates, so as to form a lantern slide. In front of the transparency there is a lens capable of being adjusted for any eye by turning it either to the left or right. No other eyeglass should be used in connection with the lens. The latter is fitted in a small frame susceptible of a vertical and horizontal displacement, so as to enable any point of the transparent map to be brought immediately in front of the eye, 175 square kilometers (67.56 square miles) being inspected with each position of the lens. The minute map is divided into squares at distances of 2.5 kilometers (1.55 miles) each, the squares being numbered horizontally at the top of the map and marked with letters in a vertical direction, thus enabling any given point to be traced readily. The slides fit loosely in the holder and they can be exchanged at a moment's notice whenever another map is to be examined.



THE LENS AND SLIDE HOLDER OF THE MICROPHOTOSCOPE.

If the lens is used in the daytime, it should be held with the handle in front of the eye, when an intensely illuminated image of the map will be obtained, so that even the smallest lines and most minute marks will be readily distinguished. For use at night an especially designed illumination box is added, including small electric light similar to the familiar "ever-ready" lamps. This box can be attached to the back of the apparatus, where it is held in place by small clips. By pressing a button a small glow lamp is lighted. This lamp illuminates the transparent map about as intensely as does daylight, and thus the lamp can be used in dim weather if more light is needed.



TOP AND SIDE VIEWS OF THE LENS MOUNTING.

The latest type of apparatus has been arranged for keeping the button pressed down permanently, thus avoiding a continual pressure on the same. A reserve battery is provided for supplying the amount of light required for twelve hours' uninterrupted service of the glow lamp, this battery being worn like the cover of a field glass. The transparencies have recently been improved by marking any waterways in a blue color.

A Novel Photometer.

The numerous attempts so far made to utilize the luminous sensitiveness of selenium for the construction of a suitable photometer have now for the first time been crowned with success, in connection with a novel selenium photometer brought out by a Mayence constructor, which is quite independent of the inertia of the selenium, the temperature of the air, and the load on the selenium cell, as well as of all other factors disturbing the sensitiveness of the selenium. The slow alteration undergone by the selenium cell in course of time is doubtless without any influence on the tests. The accuracy insured in using this apparatus greatly exceeds the accuracy afforded by any similar photometrical process, while the tests are carried out more rapidly and without any difficulty.

The novel principle used in constructing this photometer consists in throwing a selenium cell in a rapid alternation from the range of a standard lamp into the range of the lamp to be measured, the resulting current oscillations being ascertained by suitable instruments. As soon as the oscillations of an index are discontinued, the illumination produced on the cell by both of the illuminants is found to be equivalent.

The apparatus includes two mirrors lighted by the two illuminants respectively, while a selenium cell rapidly oscillating between two given positions is lighted alternately by either. The index of an ammeter oscillates in accordance with the fluctuations in illumination thus produced, and the instrument should be displaced until these oscillations are found to cease, thus showing the equivalence of the illuminations due to either lamp, when their respective distances from the photometer will, according to a well-known rule, give the luminous intensity of the lamp to be tested in terms of the standard lamp.

This photometer is intended in the first place for the comparison of illuminants of the same class. One good point of the apparatus is the rapidity with which measurements are carried out. Moreover, the eye is put to far less strain than in any other method of testing. The instrument will be found useful in connection with scientific investigation into the hitherto unknown mechanism of the sensitiveness shown by selenium in regard to light. Our present knowledge does not go far beyond the fact that two of the allotropic modifications of selenium, and especially the light-gray brittle variety, show a decrease in electrical resistance as soon as they are exposed to an illumination, this decrease being dependent on the luminous intensity of the latter.

As regards the influence of considerable differences in color between the two illuminants, selenium seems to behave very well with the luminous sensitiveness of the eye in regard to the same color. It thus seems likely that no errors worth mentioning will be made in practical tests, and it is surmised that the retina of our eye perceives in the same way as selenium, while such differences as have been found from time to time are attributable to the absorption of rays by the liquid and other membranes of the eye. A suitable compensation could thus be obtained by inserting in front of the selenium cell an optical medium equivalent to the substances lying in front of the retina.

Free Winter Course in Dairy Farming.

The Massachusetts Agricultural College offers without charge for tuition a general course of instruction in the management of a dairy farm and in dairy operations. This course begins January 2 and continues ten weeks. It is open to all citizens of the United States above sixteen years of age.

Students taking this course enjoy the great advantage of a systematic, thorough, and short course of training under recognized experts. The subjects taken up are soils, manures, fertilizers, and crops, the breeds and breeding of dairy stock, the feeding of dairy animals, stable construction and sanitation, prevention and treatment of the common diseases of stock, dairy products, their general characteristics and the laws of milk production, pasteurization, elementary botany and entomology, and general horticulture. Students receive careful training and extensive practice in the use of separators, making the Babcock test, and in butter making.

All wide-awake communities are demanding better dairy products. Students taking this course learn how to make the necessary improvements in methods of production. The demand for farm superintendents is great, but only up-to-date superintendents are wanted. Those taking this course are able to learn the latest methods. Any one desiring information concerning the course should address Prof. William P. Brooks, Amherst, Mass.

The largest marine gasoline engine in the world has been shipped from Baltimore to Russia. It is of 1,600 horse-power, and is one of four ordered by the Czar's government, at a cost of $100,000, to go into Lake submarine torpedo boats.