1. An English lens fore sight, giving $2\frac{1}{2}$ magnification, and, within a smaller field, the same effect as a telescope sight. 2. First model of the American service sight, showing prism box. 3. A closer view of a German non-prismatic telescope sight. The disk on the tube is for elevation. 4. The new American telescope sight. 5. A telescope of the American target type, terrestrial construction, without prisms, mounted on a German Mauser. This telescope is not adapted to military work because of the small field, poor light and great length. The central picture gives one an idea of what a sniper would look like through a German telescope sight.

Telescope Sights for Fighting Rifles

Increasing the Efficiency of the Infantryman

By Edward C. Crossman

NOT so very long before the war a British shooting authority and member of the War Office Small Arms Committee expressed himself in this wise:

"The best of telescope sights is simply unthinkable for war."

Evidently his government agreed with him—and now is sorry.

The British War Office is hurriedly entering into the American market with orders for telescopic rifle sights—the more and the quicker, the better. The factory making the only American telescope sight adapted to the military rifle is working night and day, and praying for more German optical glass to use in filling their British orders.

The very full and satisfactory reports from the front (this is intended as a joke) divulge the fact that the German sharpshooters, with telescopic rifle sights mounted on their straight shooting Mausers, made the British and French trenches about as safe as sitting over an open and full powder keg with a lighted pipe. Sniping as practiced by the Germans, became a fine art. A glimpse of a head at an embrasure, the suspicion that a foe crouched in the concealing obscurity of weeds or straw in the field—and immediately a German telescopic rifle sight dropped its brilliant field over the spot, a pointed picket in the field of the glass touched the object to be hit, which was of course magnified from three to six times, and immediately thereafter the casualty list became swelled by one more name.

Naturally enough, the French and the Belgians suffered as much as did the British, but the British bitterly resent being sniped. Scorning the shooting of the Germans, and proud of their own marksmanship

they regard accurate sniping as their own prerogative. After the high training of their regular force in rifle shooting, and after the few hundred thousand civilians that have been following short range rifle shooting in the United Kingdom, they feel that if there is any extemporaneous shooting to be done, they are the ones to do it.

It turns out that one or two men in every German infantry company, the most skilled shots—the "acorn" men of the organizations, possess rifles fitted with telescope sights. There is no disputing the high accuracy, the flat trajectory, and the general superiority of the German Mauser to any of the other rifles, and there is equally little use in disputing the fact that the German can shoot if he turns his attention to that game. So came about the regrettable fatality among the Allies in the desultory fighting during the winter, and the high percentage of killed among the British officers.

John Bull tells us little about how it feels to be receiver-general for the bullets of the telescopic sighted German rifles, but the frenzied orders he has sent to American factories is language that is very full and comprehensive.

Evidently "The best of telescope sights is" no longer "unthinkable for war."

The worst of the British situation the British War Office is just beginning to find out—this being that the Germans have developed the telescope sight, and with the exception of Warner & Swasey of this country, make the only practical instruments of this sort for the fighting rifle.

The telescope sight has three distinct virtues for fighting purposes. They are these: It magnifies the suspected objective just as a low power telescope of

ordinary sort would do, showing whether or not there is anything at which to fire. It enables the soldier to lay the sight accurately on a partly concealed and badly lighted mark that would be invisible over metallic sights. It acts to some extent as a range finder if the user becomes trained to note the approximate size of the objective and the needle in the field of the glass.

Needless to say, the virtue of allowing the soldier to aim accurately at a nearly invisible objective is the chief one.

Optically the telescope sight is a terrestrial telescope of low power, rarely going over six power or six linear magnifications for practical work because of the loss of light and field of view that follows higher powers. The best types are the prismatic, like that used on the United States army rifle.

In this instrument, and in similarly constructed ones like the Zeiss of Germany and the Goerz, the image, gathered by the large objective lens, is brought right side up again from its inverted position by a prism or prisms, and then is delivered to the eye by the bright and simple astronomical eye-piece. In this it follows out the construction of the well known prismatic field glass.

In the Zeiss and in the Warner & Swasey, used by the American Government, the prisms shorten up the instrument into an elbow-joint affair instead of the long, more bulky tube of the ordinary telescope with a set of plain terrestrial lenses.

The line of collimation of the lenses is the aiming line. Placed within the glass in most of the German instruments is a little steel needle, sharpened at the top and extending just half way up the field as seen by the eye. It is magnified by the eye-piece until it appears

possibly the width of a man at 400 yards. The process of aiming consists of nothing more than placing the sharpened end of this picket on the thing to be hit, which is of course magnified by the instrument.

So the soldier sees through the glass, perched on the rifle, just the view that one would see through a low power telescope of the finest possible construction, but sticking up half way across the field is this steel picket, to be placed on the object to be hit. The instant the magnification of the lenses tells him that the suspected object needs shooting, he gently touches it with the needle and squeezes the trigger of the powerful rifle.

Adjustment for range with the German glass is obtained by turning a milled dial set on top of the tube. In turn this moves the frame in which the sharp picket is set, raising or depressing it. As it is like a front sight, lowering this picket in the tube raises the muzzle of the rifle again to bring the point back on the thing to be hit. So, depressing this picket alters the sighting for longer range. This dial is graduated for range.

The German glass is usually fastened to the rifle by fixed steel hooks on the glass itself, that drop into corresponding recesses cut in plates screwed to the rifle. The pressure of a lever or catch frees the hooks and allows the glass to be detached.

The American Government adopted the Warner & Swasey instrument in 1908, and later on decided to issue two telescopic sighted rifles to each infantry company, the best shots of course drawing them. Possibly some secret tip from our military attaché in Germany decided our army men to do this, but our own telescopic rifle sight is carried out to a much higher form than any of the Continental instruments—for military purposes.

It is this instrument, or a close approximation thereto, that the British are now buying for their army.

The American army glass is about seven inches long and looks like a little steel box with a tube protruding from either end. In one tube is set the object glass, in the other the eye-piece. A rubber eye cup is fitted to keep out extraneous rays of light, and regulate the distance from eye to glass. It is hardly necessary to say that the optical construction of this and all similar telescope sights must allow the eye to get the whole field of view, and stay from two to three inches away from the eye lens. The recoil of the rifle makes closer acquaintance very unsafe. For this purpose the eye-piece is made very large, thus affording the necessary "relief" between the eye and the lens.

The United States Army glass is mounted on a steel plate screwed to the side of the new Springfield, and the instrument extends back over the stock to the comb.

Elaborately engraved milled dials on the left side of the mount give elevation up to 3,000 yards, and "windage," or lateral movement as well. Porro erecting prisms occupy the little steel box, and a fine Steinheil triple achromatic lens is used for the eye-piece.

Instead of the picket point of the German glass, the American telescope is provided with a plain glass lens, or "reticule," on which are etched horizontal and vertical lines, the cross-hairs of the familiar surveyor's transit. "Stadia" lines are also etched on this glass, so spaced as to span the height of a man of 5 feet 8 inches at 1,000 yards. This much to make the telescope a range finder as well as a telescope. The power is six, that is an object is magnified six times lineally, a foot-high post is made to appear six feet high, etc. The aiming point of this glass is of course the intersection of the cross-hairs or lines etched on the plain piece of glass inside the tube.

The elevation and windage of the glass is altered by the milled dials bearing on levers on which the whole glass is pivoted. On top of the instrument is an engraved table giving wind and range and drift figures.

The instrument is of course devised for the use of the most skilled long range shots—the close range trench sniping of the German-Allies fighting probably not entering into the calculations of the designers. For this sort of work the American glass would be better in a lower power of magnification, with the added light and field of view that comes from the lower power. Quick snap shooting—or the semi-snap shooting that a sniper would do at heads appearing over an opposing trench within a few hundred yards indicates a wide generous field, and plenty of light for the poorest conditions.

One of the most useful features of the telescope sight of adequate light, is the fact that it makes possible accurate shooting in the dusk, when metallic sights could not be aligned on even a contrasting objective.

Carbureter Heating.—A European patent consists in an electric method of heating the gas mixture of the carbureter, especially at starting the motor when this is cold, and thus it assures an easy start and good gas conditions for carbureter with all fuels such as benzol or alcohol. The electric heater consists of fine German silver or other wire wrapped around a thin tube of metal and insulated with mica and asbestos or other suitable material. This wire is brought to a high heat by the current.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Practical Devices and the Lack of Capital

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial and Mr. Atwater's letter in the issue of May 29th both point out a crying need for the good of the country. Mr. Atwater suggests that a "captain of industry, or some syndicate" could have taken advantage of Mr. Porter's fertile mind and "the world would have been the gainer." This of course can be said of almost any fertile mind, and it is probably out of the question to expect any arrangement to make use of all the possibilities.

But there are bright exceptions and it is a disgrace that the powers that be and the business men of this land have not long ago made some arrangement to exploit properly the waiting opportunities for adding to our national wealth. We see almost every year "bread lines" and "soup kitchens" feeding by charity men who would be proud to earn their living if they could find work. We hear constantly reports of "no work" and yet all around us are undeveloped devices that would give work and add much wealth to the world if somebody would take them in hand and develop them.

While not so noticeable there is undoubtedly plenty of capital waiting for more profitable employment and plenty of men with money anxious to get in touch with some device in their line that offers a chance to make a good profit. That many great things lie unheard of for years is due simply to lack of means for bringing them together. The man who specializes in manufacturing or selling is not often also an expert in devising. The man who spends his life searching for new things can hardly expect to be an expert manufacturer or salesman.

The Wright brothers spent years of time and all the money they could get learning how to fly. Having accomplished this wonderful feat, tried for since the dawn of history, they then could find no one who would finance them and help them to get their devices on the market. After some years they were forced to go abroad and found their needed help in France. Unpatriotic and unbusinesslike to say the least. Yet undoubtedly there were many men of wealth and business ability who would have been more than glad to have had a chance to take these men in charge and win a name with them as well as make money for all concerned. The problem was to find them. No machinery exists for that purpose. The old "needle in a haystack" method is the only one available.

The automobile is another example. The first successful modern automobile was built in Springfield, Mass., in 1891-2. Others followed and won the first two and only contests of importance in America and the first contest in Great Britain. These contests were held in 1895 and 1896. Many attempts were made to find capital. The leading bicycle and carriage makers were appealed to; as were men in many other walks of life. But the inventor, having spent his money producing the article, had none left to find the factory connections needed. He was not offering a patent or a mere idea, but a thoroughly tested and demonstrated vehicle, the fame of which was even then world wide.

He failed to find the help needed. The gasoline automobile languished and it was not until several years later that the little toy steamer with money behind it was put on the market in quantity and sold faster than it could be made. The biggest part of ten years had slipped away before the great public learned that the gasoline automobile is the most practical one and the manufacture of them began to assume a prominent position. In the meantime other countries had gone ahead making gasoline cars, and for years we had to go abroad for the best, although our own land had at the first clearly the lead.

Letting opportunities slip through our fingers for other countries to pick up is certainly not good business. Every State could well afford to maintain a bureau to help remedy this lack. Certainly this great United States should have such a bureau. It is even more important that the factory and the article get together than it is that the man and the job find each other. The man who has the factory and the article to make will find the men, for he knows men can be found; but lacking the article he knows not where to look.

The bureau should be known to be open to consider any device that has been put into practical or actual use. It should have such connections with practical men in every line that it can submit these devices to them for opinions. It should, after being satisfied that the device has merit, bring it and the organization that can make and market it, together and stand over them to see that failure does not result from lack of capital, experience or modern methods of making and selling.

The inventor should know that with the bureau standing sponsor for his device it will not fail from lack of proper pushing, and that he will get a fair share of the profits that arise. The manufacturer should know that the bureau's investigations cover the subject far better than he himself can, and that his chance of hitting a winner through the bureau selection is far greater than trying to pick it unaided. The bureau should be largely supported by the Government, but could with propriety receive a percentage of the part that may go to the inventor.

Such bureaus would save the manufacturers much time by weeding out the valueless things; complete indexes of experiments would save much repetition of experiments; but the great gain would be that the really valuable things would get into the market, making the country richer without loss of time. It is foolish to cry "Poor Business" and not make the effort to make business good.

CHARLES E. DURYEA.

Philadelphia, Pa.

The Three-wire System

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of June 5th, 1915, page 575, you state that the three-wire system of direct-current distribution was first put into commercial operation in 1883 at Sunbury, Pa. Between 1868 and 1873, George H. Snow, who was the draftsman and mechanic employed by the Hall railroad signal system, wishing to place several electric batteries together in one house that had to be heated to prevent the batteries freezing, found trouble in that his signal that was nearest the battery short-circuited those farther away. To obviate this he invented the three-wire system. Henry, inventor of the Henry rifle, was personally acquainted with Snow at that time and must have known of Snow's use of the three-wire. George Coe was a partner in the firm of Snow & Coe of New Haven, Conn., and if he is alive no doubt he could give the precise year that Snow first used that system. Hall's patent should mention this use.

E. H. HAWLEY.

Washington, D. C.

Deflecting Rays Downward

To the Editor of the SCIENTIFIC AMERICAN:

The article on page 345 of the April 10th issue of the SCIENTIFIC AMERICAN is of more than passing interest to me, and if I may be permitted, I would like to contradict the description that you have given.

This description would be correct provided the lamp's illuminative filament was in the exact center of the lamp globe, because then the reflected rays from the reflective surface of the small bowl would impinge upon the upper portion of the reflector at the same approximate angle as the light rays direct from the filament. In adjusting the lamp globe in the headlight for use with the bowl you mention, the lamp itself is set in such a position that the upper portion of the reflector will reflect its rays below the line of the horizontal axis of the headlight. Then the other light rays from the small bowl will strike the upper reflector at a different angle, and naturally will be in turn reflected at a different angle.

By a careful study of my statement you will find that I am correct. I have done a great amount of experimenting along this line, and would say that light projection by means of a parabolic reflector is more complex than it would appear to casual examination. Also, this kind of light reflection cannot be calculated theoretically for the reason that it is impossible to obtain a perfect reflective surface, and it is also impossible to obtain a source of light emanating from a perfect point.

Denver, Col.

R. F. WILSON.

Sir Sanford Fleming

SIR SANFORD FLEMING, the Canadian engineer and scientist who was instrumental in getting Greenwich time adopted by the railways of the United States and Canada, died recently at Halifax at the age of eighty-eight.

He was a Scotchman by birth, born at Kirkcaldy. He emigrated to Canada in 1848, where he was connected with railroad matters a large portion of his life, having been associated with most of the large enterprises of that kind. He was the engineer of the Northern, the Intercolonial, and for several years chief engineer of the Canadian Pacific, of which road he was called "the Father."

His later years were devoted to literature and scientific research; and he served many years as chancellor of Queens University. He received many honorary degrees, and a number of decorations had been conferred upon him. He wrote a number of books, among which were "Time and Its Notations," "Memoirs of Universal Time and a Prime Meridian for All Nations" and "The New Time Reckoning."