Electricity and the Range-Finder in War

AS many people are aware, the matter of determining accurately the range between a certain gun or battery of guns and the enemy target, is a very important factor in all military and naval maneuvers. Not so many years ago when the range of artillery was quite insignificant compared to that of today, the matter of *range-finding* as it is known, was an unknown study. All that the officer in charge of a gun battery had to do in those days was to check up the first few shots fired and by watching the effect and the point hit by the projectile thru his telescope, or in many cases simply with the naked eye, the particular gun firing the shots could be readily elevated or lowered so as to change the trajectory of the projectile. But in the past twenty-five years the hit and miss principle of range-finding has been done away with, and a number of more or less accurate range-finding instruments developed, some of which are very ingenious indeed, and extremely accurate for comparatively long ranges.

The photograph herewith shows one of Uncle Sam's latest types of accurate range-finding instruments installed on board a modern dreadnought. The Jackies are shown in the act of determining the range of an object which has been selected as a target for the ship's giant guns, several of which can be seen in the background protruding from their turrets. The operator peering so intently into the eye-piece of the range-finder, and who is wearing a pair of sensitive telephone receivers as well as a transmitter strapt to his person, is one of the most important men in the crew of any fighting ship whether large or small, for if he makes an error in reading the dials of the range-finder, then the enemy may escape being hit. As becomes evident, time is the essence of every naval engagement, for in a few minutes time the enemy if not disabled by your own guns will in all probability plant the major part of a broadside on your superstructure and gun deck, possibly disabling your own battery.

Thus we see that the man at the range-finder has a very important mission to fulfill, when he straps the head 'phones and transmitter on, and proceeds to turn the lenses and other paraphernalia fitted on the range-finding tube, for it is he who controls the sighting of the big guns. It is he who determines the range or changes in range, etc. He telephones these figures to a staff of engineers who are in constant touch with the "gun pointers" in the turrets below. A single range-finder may be quickly disabled even in a long range engagement, and so every war-ship carries at least two range-finders. The large super-dreadnoughts carry as many as a dozen on board, some of them being situated on top of the steel fire-control masts, while others are located in less conspicuous locations.

The diagramatic illustration herewith will help to explain how the modern range-finder does its work. Referring to Fig. A, we have a sectional view of the present day "one-man" range-finder. This comprises two prisms known as the right and left prisms, which are made adjustable by means of thumb screws protruding from the casing of the apparatus. The right and left prism telescopes can be trained on the distant object, and the refracted rays from the prisms are past thru a pair of objective lenses in the manner illustrated. These right and left rays pass along thru the center of the blackened range-finder tube and meet in the center where there is positioned two central reflectors. At this juncture it is well to note the two views shown in the circles at the bottom of Fig. A. These two views show the image of a distant target (a church) as it appears in the eye-piece of the range-finder, before the right and left prisms are adjusted to "coincidence" and "after coincidence," the latter or right hand view being the one observed by the range-finding officer at the point where the instrument indicates on a specially calibrated dial the *correct range in yards.* As will be noted from Fig. A, the upper semi-circular image is the one reflected by the left hand prism. A dividing line separates the two images, and in the present case the instrument is adjusted until the tower of the church slides along toward the left until it is exactly in line with the remaining portion of the tower appearing in the lower image.

So much for the physical action of the "one-man" range-finder. But this does not tell us yet just how the range is determined, excepting that we have learned that when the images coincide, that the instrument indicates the range in yards on a calibrated dial. Probably we will do best to go back a few years to the time of the Boer War in South Africa. At that time the English Army had considerable range-finding to do down among the Köpjes of "Oom Paul's" land. Briefly explained, the "two-man" range-finder then used works after the fashion illustrated in Fig. B. It must be considered before going further, that every

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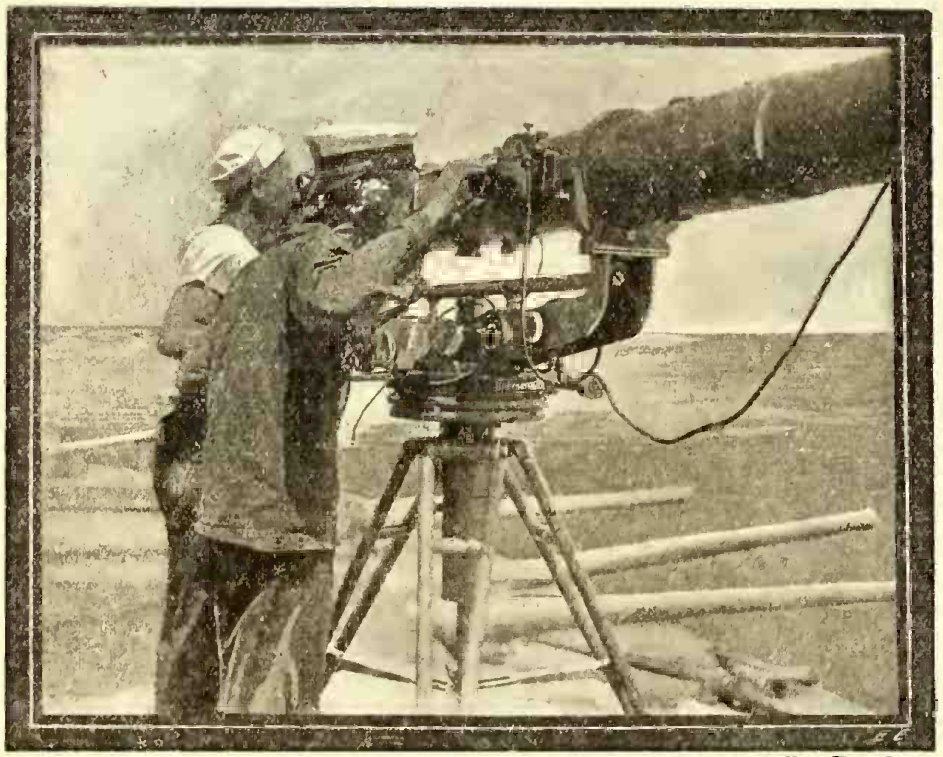
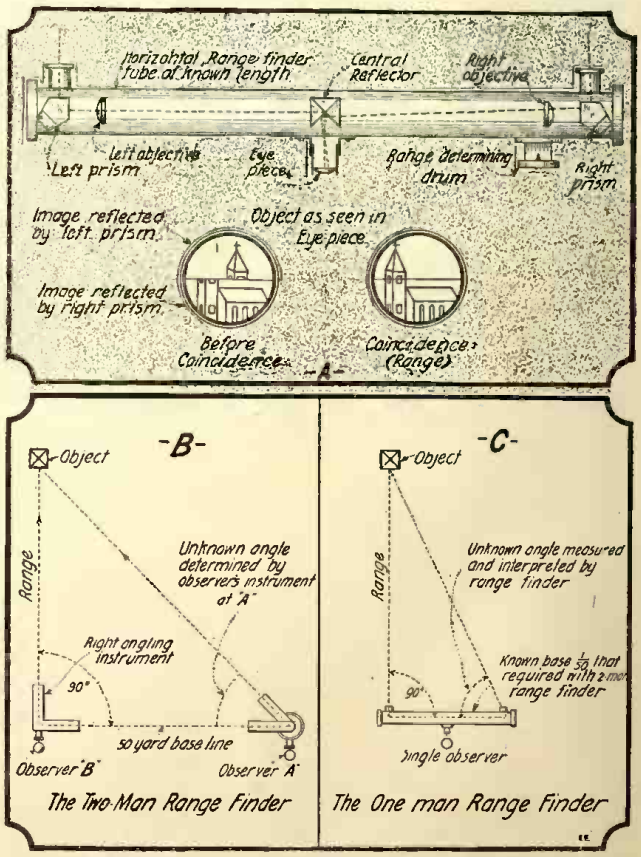


Photo by Central News Photo Service

Getting the Range. Jackies on an American Battleship Getting the Range by Means of the "Range-finder." The Man with the Telephone Apparatus Attached to His Head Controls the Sighting of the Gun and Telephones the Men in the Turret When the Object Is In Range.



Details of Range-finder and How the Range Is Automatically Calculated When the Base and One Angle of a Right-angled Triangle Are Known.

remedies this fault. From this it will be seen that the main driven shaft is connected to a differential and the energy is transmitted thru a regulator to the motor. When the energy developed by the mill is greater than needed, the excess energy is used to wind up a weight. The wind is not a constant source of energy, and even when there is a moderately stiff breeze I have often noticed the wheel will stop for a few seconds. When this occurs, the weight descends and a ratchet prevents the shaft reversing the energy from the weight passing thru the differential and keeps the generator up to normal speed."

A. The illustration shows this invention, and we think it is a very clever idea, altho we do not have any means to tell how it will work out in actual practice. We believe that a patent can be obtained on this device; as far as is known to us, nothing like this exists.

Umbrella.

(249) A. G. Atchison, Santa Barbara, Cal., encloses sketch of an umbrella with a small front window which our correspondent claims is very desirable when walking against a strong wind. A small window which could be made of celluloid or isinglass is so placed on the lower side of the umbrella thru which the pedestrian is able to see the approaching person. Our advice is asked, if this idea is patentable.

A. This is not a new idea, a patent of this kind having been issued years ago, and similar umbrellas are actually being manufactured and sold.

Lamp.

(250) Harris Neil, Laurium, Mich., has thought out a bulb containing two filaments, one for bright light, the other for dim light, having the screw section extended to permit a switch to be operated. Our correspondent claims that there are several dimming devices on the market, but thinks that they are too expensive, while he believes his device can be manufactured cheaper.

A. In the sketch and illustration submitted to us we fail to see that our correspondent's device would work any better than the ones on the market now. Furthermore, we doubt very much if it can be manufactured at all due to technical difficulties.

NEW RESEARCHES ON THE ELECTRIC BASIS OF MATTER.

The science of electricity has now extended its range into almost all other branches of knowledge. The largest and perhaps ultimately the most important, is that of the strength and elasticity of materials. According to the researches of Dr. Herbert Chatley, of London University, who has contributed a series of papers to the Physical Society of London (England), the whole basis of molecular force is electrical.

It is now fully accepted by physical chemists that chemical affinity is due to the elementary charges on the atoms. Many believe in Stark's hypothesis that each valence bond is formed by a free electron so that a multivalent atom is like a multipolar magnet. Dr. Chatley has shown that the molecular force of cohesion between heavy molecules is ten to the thirtieth (a million-million-million-million) times greater than gravitation and about one hundredth the electrostatic force between a positive atom and an electron. He considers that the fields of the atoms and electrons do not lie wholly within those bodies and that there is a stray field in the adjacent ether which has the effect of making the groups (molecules) attract each other with forces of one or more per cent of those of the electrostatic linkage. These fields are not uniform but are complexly polarized, so causing crystallization when the molecules are free to settle in the positions of maximum stability. Within about one and one tenth molecular diameters at ordinary temperatures, these forces predominate over the repulsion due to the kinetic energy of oscillation of the molecules, but at greater distances they rapidly diminish until at about ten molecular diameters the effect is simply that of gravitation.

He thus provides a working hypothesis for the basing of the whole of physical science on electrical forces and motion. There is first the electron or primary ether whirl, which constitutes the elementary negative unit of electricity. Grouped about the mysterious *positive nucleus* the electrons form stable structures with immense kinetic energy, the atoms. Losing or gaining one or more superficial electrons, the atoms become charged and attract one another to form molecules. At close quarters there is a stray field which draws the molecules together and at remoter distances the excess of attraction between dissimilar charges over the repulsion between similar charges causes gravitation (Sutherland's hypothesis).

It is conceivable that this hypothesis, if true, may indicate new electrical methods of treating materials so as to greatly enhance or reduce their strength.

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range-finder no matter what type, operates on the principle that a fixed or known base line of a triangle must be utilized. So we find that with the "two-man" range-finder, used for a considerable number of years, that the procedure was as follows: The fixt and known base line was formed of an imaginary cord stretched between the two range observers "A" and "B." Suppose that observer "A" equipt with an angle-measuring instrument sights a certain object, let us say a factory, of which the range is desired. The second observer, "B," now advances to the point where, when sighting thru his right-angling instrument, he sees both the building in question which forms the "object," and also the sighting vane on observer "A's" instrument. At this moment "B" shouts, "On!" and observer "A" proceeds to adjust his range-finding (angle measuring) instrument until he also makes the reflection of "B's" sighting vane coincide with the object seen in the instrument, and the range is then read off the range-finder dial in yards. This arrangement is a simple one, but is difficult to apply in modern military maneuvers and battle conditions for the reason that a very long base line of about fifty yards length is required. As every student of trigonometry and geometry will perceive, the mathematical solution of the problem is quite simple, for it is based upon the elementary law of trigonometry that with a right-angle triangle having a known base, then the altitude can be determined when the angular value of the opposite angle is known.

The same principle holds good for the "one-man" range-finder shown schematically at Fig. C. In this case the range-finder tube is mounted on a tripod of suitable design so that it can be swung around on a vertical axis as required. This instrument is calibrated to solve the same unknown quantity, viz.; the *range,* by determining the angle at the lower corner of the right-angle triangle as shown. To take the range with this simplified instrument the operator proceeds to focus the right and left hand prism telescopes of the instrument on the object; he then rotates the range index which causes the right hand prism telescope to be inclined inward and he carefully adjusts this part of the apparatus until the two images in the central eye-piece accurately coincide, when the range in yards of the building or other object can be read off the calibrated index drum.

The photograph herewith showing American Jackies using a large range-finder on a battle-ship, illustrates one of the more recent and extremely high-power range-finders for use with long range guns which can fire a shell twenty to thirty miles. However, some of these "one-man" range-finders such as used in the Army and by the Marines, measures about one yard in length and can be readily carried by the observer or by his assistant. This small portable range-finder weighs but five and one-half pounds and the operator equipt with this truly remarkable and extremely simple instrument is enabled to rapidly and accurately determine the ranges of targets up to twenty-thousand yards distance.