

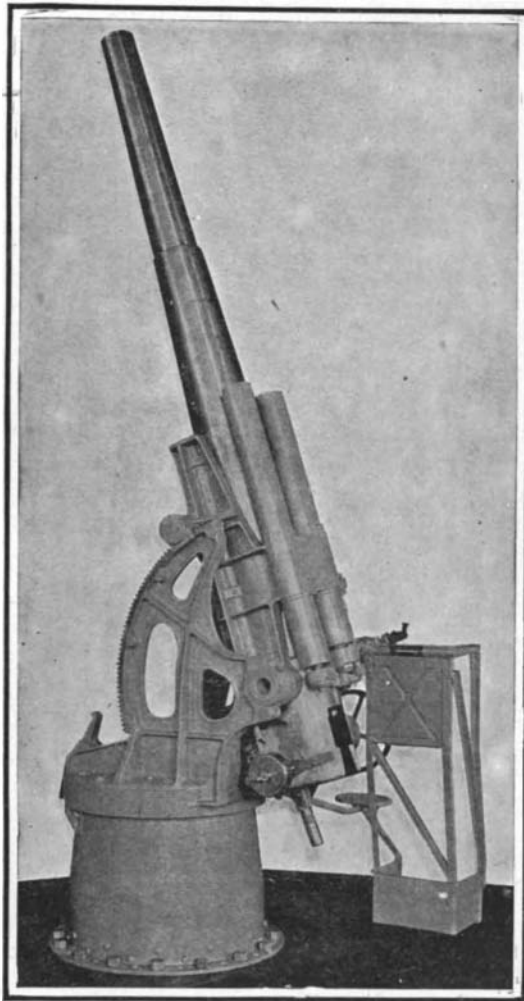
ARTILLERY FOR AIRSHIP ATTACK.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

After having carefully studied the problem which is presented by the conditions of firing at great heights and at a large angle such as is required for use with airships, aeroplanes or balloons, the Krupp firm has brought out three general types of cannon, each of which is adapted for a special use. In the first place we have the more simple type of cannon with field mounting, while a second type is constructed with a view of being placed upon a motor car. For use on shipboard they design a third type which is represented in our engraving. In the second and third cases, the cannon is designed to be rapidly rotated in all directions by the use of a central pivot base such as is usually installed on vessels and for coast defense use. On the other hand, the field gun has its wheels arranged so as to turn upon pivots, which allows of placing the wheels in the crosswise direction in the position here shown. In order to give effective results it is found that the angle of elevation must be at least 70 degrees, and the field gun is designed to reach this angle. The automobile and ship cannon will, however, make a greater angle, the maximum being for these two types as high as 75 degrees. In all these cases a rapid rate of firing is given by an automatic opening and closing of the breech. The caliber has been reduced as much as possible, as also the weight of the projectile, while the long bore gives a high initial speed to the shot and diminishes the time required to attain the mark. Owing to the lessening of the caliber, greater lightness is obtained, and this is of service especially in the field and the automobile types of gun.

Sighting is carried out in the most efficient manner by the use of an appropriate form of sighting telescope in combination with a general finder which covers a wider range of field. There is also a range-finder by which the distance is first obtained, and afterward the indications are directly given so as to be able to point the gun for different heights of the airship without loss of time, and thus the use of firing tables is dispensed with in all these cases.

The question of the kind of shot which is best adapted for firing upon balloons or airships is of prime importance; and this matter has been made the object of a number of experiments. It is recognized that shrapnel will penetrate the balloon envelope, but without doing much damage at least of an immediate nature, seeing that the holes are closed again for the most part by the internal pressure of the gas, so that the loss of gas is not a rapid one and the airship is able to reach a place of safety in the majority of cases. It is found that the most effective form of projectile is a special kind of grenade, which is designed to explode in the interior of the balloon and to bring about ignition of the gas. The new projectile designed by the Krupp firm is intended to accomplish this, and at the same time the path of the projectile from the time it



The 4.2-inch Krupp gun for aeronautic attack, on a naval mount.

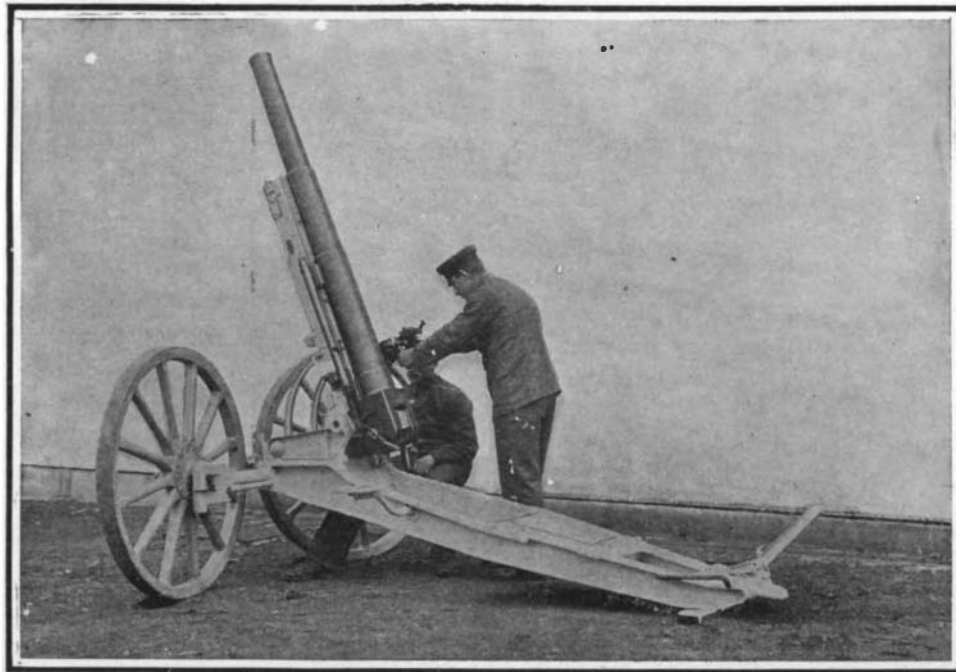
leaves the gun can be followed by the use of a special smoke producer carried on the shot. By observing the trail of smoke the gunner learns whether the shot comes near the mark. When the projectile leaves the gun, the smoke producer has been set working by an appropriate device. At night the path of the shot is still followed by the light which the smoke producer gives out. When it penetrates the envelope, a very sensitive device causes the detonation of the grenade.

In the case of the field cannon, which has a 6.5 centimeter bore (2.6 inches), the weight of the gun itself is 775 pounds and that of the chassis 1,150 pounds, making a total of 1,925 pounds for the cannon when prepared for actual service. The gun can be turned about through a complete circle, and has a maximum vertical angle of 70 degrees. The weight of the projectile for this type is 9 pounds. The initial speed of the shot is 2,050 feet per second. With the field gun it is possible to cover a maximum range of 28,550 feet, and a maximum height of 18,800 feet.

Of a heavier build than the former, and also of greater range, is the second type of gun of 7.5 centimeter (3 inch) caliber, which is designed to be mounted upon a heavy motor car, as we represent it in our engraving. Like the former, it is provided with hydraulic recoil brake, and in the present case there is used a middle pivot. For elevating and lowering the gun through the required range there is used a double-toothed sector which is driven by pinion and crank. A special arrangement is used for the rotation, by which a slow movement is obtained, but a quick rotation may also be given by a more rapid mechanism when it is needed to turn the gun rapidly into any desired position. It is to be noted that, owing to the high speed at which the airships move, such quick movements are one of the features which need to be especially designed in the case of guns for balloon firing. The weight of the gun itself, or 990 pounds, combined with the weight of the support, 1,550 pounds, gives a total weight of 2,540 pounds for this type of gun. We have here the maximum angle which is reached in the Krupp cannon, or 75 degrees. The weight of the projectile is 12 pounds, and the initial speed 2,060 feet per second. The maximum range is about 30,000 feet, and the greatest height about 20,000 feet. As regards the automobile car which is designed to take the present cannon, its total weight (exclusive of the gun) is 3½ tons, and it has an average speed of 30 miles an hour.

Owing to the fact that both axles are driving axles, with the use of the 50-horse-power motor the automobile car is able to travel over very difficult ground, and it easily mounts very steep grades. Under the front seat is a roomy chest which holds a good supply of tools and extra fittings, and special attention has been given to this point so that the car will not easily become disabled. To make the platform of the car as steady as possible during the firing, the platform

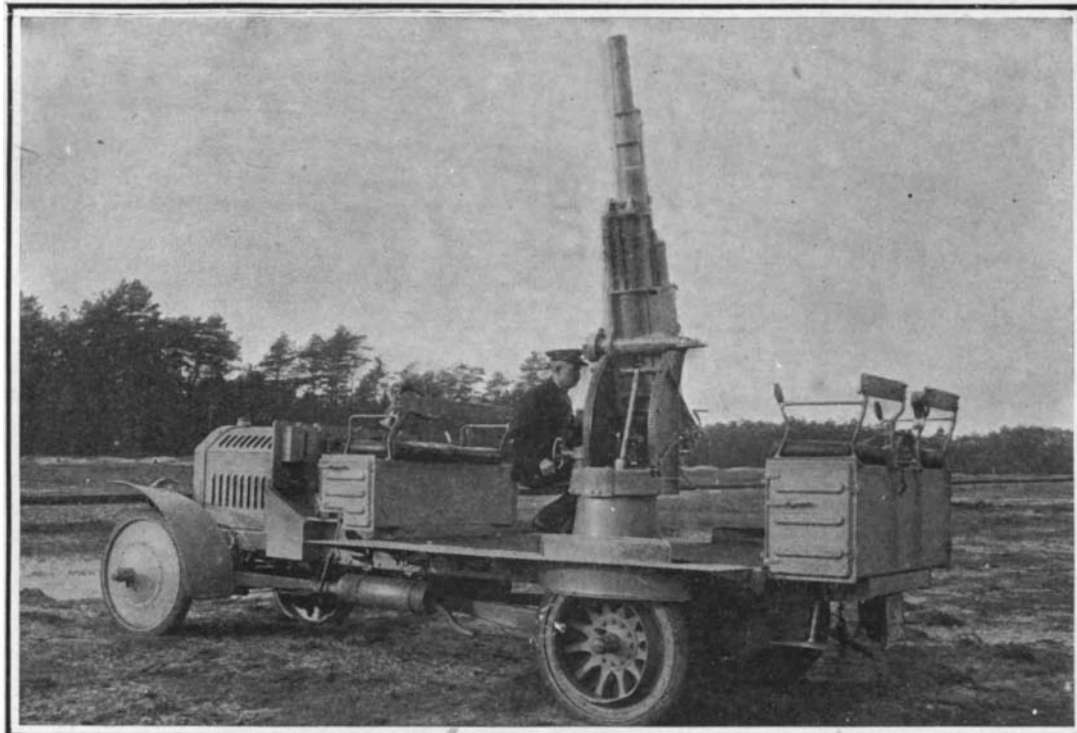
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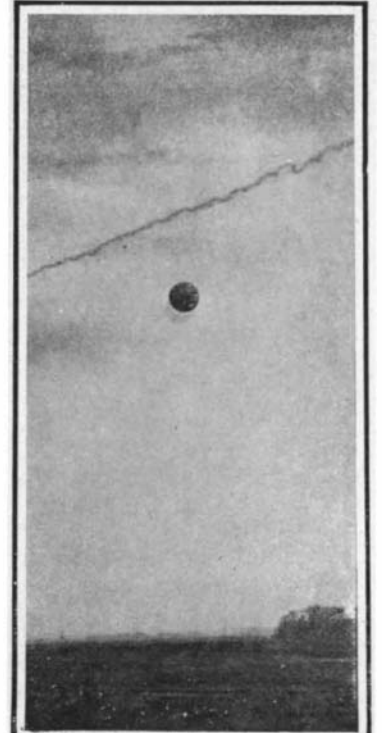
Bore, 2.6 inches; projectile, 9 pounds; velocity, 2050 f. s.; maximum range, 28,550 feet. Field gun for airship attack.



Destruction of a captive balloon by a special form of aeronautic grenade.



The 3-inch 12-pounder Krupp field piece for airship attack. The weapon can be brought to a maximum elevation of 75 degrees. The motor car on which it is mounted is of 50 horse-power and has an average speed of 30 miles an hour.



The projectile emits a train of smoke which marks the path of its flight.

(Concluded from page 381.)

eighteen months, and containing the imbedded organs of fowls dead of spirochaetosis, were lost, and thus a far-reaching investigation has been temporarily arrested, and it has not yet been possible to replace the material. Upon the receipt of the news of the catastrophe, Mr. Henry S. Wellcome, to whose munificence the Institution was due, immediately offered to replace the lost equipment; and through his generosity the laboratories were completely refitted and re-equipped with the most modern appliances, so that work could be resumed with the minimum delay. Consequently, so far as general usefulness goes, the Institution was only temporarily crippled.

Work is now again in full swing, and it should be pointed out that there is a very large field to be covered yet. If the various countries interested in the exploitation of the continent could establish similar laboratories to this in their respective territories, it would soon become a white man's land, and through concerted action the terrible maladies which at present arrest development would be completely subjugated.

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is clamped tight against the axles. The third type of cannon is of a much heavier build than the two which precede, seeing that in this case it is designed to be mounted on shipboard, and hence the weight does not need to be reduced as in the other cases. It is of a considerably larger caliber, this being 10.5 centimeters (4.2 inches). In most of the details it is designed on the same lines as the second type. It is intended to be mounted generally upon torpedo boats or swift cruisers, and naturally the gun can be brought into service as an ordinary cannon in cases where it is needed. For the gun proper, the weight is 3,080 pounds, while the support weighs 3,520 pounds, giving a total weight of 6,600 pounds for this type. Like the former, the angle of elevation is 75 degrees at a maximum. The projectile, weighing 40 pounds, has an initial speed of 2,300 feet per second. A horizontal range of 44,500 feet is reached in this case, and we have the unusual height of 37,620 feet.

The present types of gun were given a series of tests by firing upon captive balloons, and two of our engravings illustrate this feature. In one case we observe the balloon, which has not been hit by the shot, and this can be clearly seen by the trail of smoke which shows the path of the projectile. In the second view is represented the effect which takes place when the projectile strikes the balloon, and we have the detonation of the grenade and at the same time the explosion of the gas and the destruction of the balloon.

Alcohol vs. Gasoline Engines.

Almost any engine with a well-designed carbureter will run as well with alcohol as with gasoline, except for a difference in ease of starting and in certainty of operation at low speeds. By using alcohol in an alcohol engine with a high degree of compression the fuel-consumption rate in gallons per horse-power hour can be made practically the same as for gasoline in a gasoline engine of the same size and speed. An alcohol engine with the maximum compression for alcohol will have 30 per cent more available horse-power than a gasoline engine of the same size, stroke, and speed, and the weight per horse-power may be less. Tests with mixtures of gasoline and alcohol showed no gain in efficiency over gasoline or alcohol alone. Diluting gasoline with water did not affect fuel economy.

With alcohol the case was different, but with dilutions up to 80 per cent alcohol the effect was so slight that 80 per cent alcohol is a cheaper fuel than 90 per cent if it can be had for 15 per cent less.

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The Middle West Number of the SCIENTIFIC AMERICAN

On December 11th, 1909, the Scientific American will issue a number devoted entirely to the wonderful Middle West region of the United States, a number which will set forth broadly and lucidly not only the agricultural interests of that region, but also those larger engineering undertakings which are destined to transform the Middle West in part at least, into a manufacturing territory.

With that object in view the Middle West Number will publish articles on the following subjects:

- I. The Chicago and Gulf Waterway.**—An illustrated description of Chicago's drainage canal, an engineering work which stands without a parallel in the world.
- II. Chicago as a Railroad Center.**—Chicago is the greatest railroad center in the world.
- III. The Wonderful Grain Trade of Chicago.**—Chicago is an enormous wheat bin, into which much of the grain raised in the middle West is poured.
- IV. Shipping on the Great Lakes.**—Most of the iron ore that is now smelted in Pennsylvania is mined in the middle West. To transport it to the blast furnaces of the East at a cost which will enable American steel makers to compete with foreign steel makers, it has been necessary to devise a new kind of lake transportation. Ships of 10,000 and 12,000 tons burden have been constructed which convey ore at small cost through the Great Lakes, and which are without a counterpart anywhere in the world.
- V. The Handling and Shipment of Iron Ore.**—The above-mentioned fact that iron ore is mined in the middle West and smelted in the East has necessitated not only the construction of special freight-carrying steamers, but also the designing of special machinery for loading and unloading the ore from the steamers.
- VI. Freightage on the Mississippi.**—Freightage on the Mississippi is a more important industry than most of us may realize.
- VII. The Steel Industry.**—One of the greatest steel plants in the world is that which has been built at Gary.
- VIII. The Freight Subway System of Chicago.**—Chicago can boast of a rational system of handling freight by means of subways.
- IX. The Water Supply of Chicago.**—Chicago's source of water is Lake Michigan. The city is supplied with water by means of a tunnel which extends two miles out into the lake.
- X. Reclaiming Arid Lands.**—The United States Government has under way many irrigation projects for the purpose of reclaiming lands which are arid, but which will blossom if properly watered.
- XI. Harvesting the Grain of the Middle West.**—Farms that cover not acres but square miles, crops that aggregate not simply bushels but car-loads, have rendered it necessary to plant and harvest on an unprecedented scale in the middle West. The ingenious agricultural machinery which has been designed to cope with these peculiar conditions is described and illustrated.

The Middle West Number will be more than twice the size of the regular SCIENTIFIC AMERICAN. It will be lavishly illustrated. It will be contained in a colored cover which strikingly depicts Chicago's grain elevators at work. Order from your newsdealer or from **MUNN & COMPANY, Inc., 361 Broadway, New York City**

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