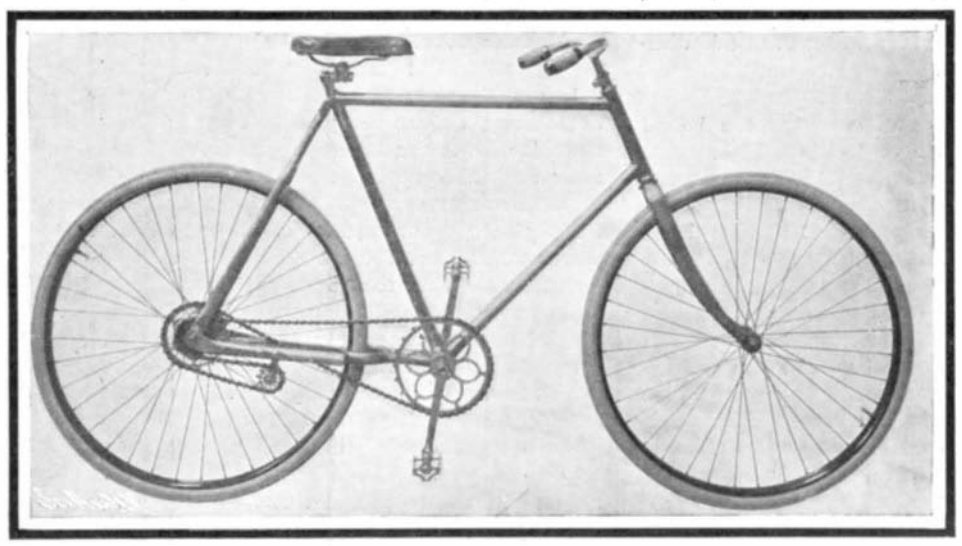
A GEARLESS TWO-SPEED BICYCLE.

Notwithstanding the aversion that bicyclists have for back pedaling, the Manufacture Francaise d'Armes et Cycles of Saint Etienne, France, taking as a basis the fact that back pedaling entirely abolishes the dead point, more rationally and completely utilizes the motor muscles, and gives greater efficiency than direct pedaling, has just constructed a very interesting two-speed and free-wheel machine. The two speeds are obtained instantaneously, automatically, and while running, with a single chain without gearing or controlling mechanism.

It is, upon the whole, an ordinary bicycle, but one in which the chain runs over two sprockets instead of one and gives, without supplementary friction, one speed by pedaling in the usual manner and another by back pedaling. For changing the gear, it suffices to change the direction of pedaling, an operation that may be performed instantaneously and so easily that it is possible to pedal one revolution forward and one backward, that is to say, to change the gear at every instant without any interruption in the operation of the machine. If the cyclist stops pedaling, the chain and sprockets will remain immovable and the machine will come to a standstill.

Thanks to a special arrangement of the pedal bracket, the chain never pulls obliquely, but always directly, that is to say, parallel with the axis of the machine. Besides, it is only one of the halves of the chain that



A SIMPLE TWO-SPEED BICYCLE.

works. In direct or forward pedaling, it is the upper half, and in back pedaling, the lower. All the rest of the chain is slack and runs idly as in an ordinary bicycle. The small wheel merely supports the chain and reverses its motion. It is therefore submitted to no stress, and, as it serves to regulate the tension of the chain, there is no need of two rear stretchers, and the wheel is not apt to get out of order.

This new machine weighs but a few ounces more than an ordinary bicycle, and all its parts are handsome, very simple, exceedingly strong, and of careful construction. It offers, in fact, an ideal solution of the problem of a bicycle having two speeds and an automatic change of gear which is exceedingly simple and inexpensive.

A BAD CASE OF GUN EROSION.

The high velocities and increased energy of modern guns have not been obtained without the sacrifice of other desirable elements in the gun. The most serious trouble that confronts the modern artillerist is the tendency of the smokeless powders, that are now exclusively used, to burn out the interior lining of a gun, particularly near the powder chamber. The powder itself is the cause of more or less anxiety because of its chemical instability. In our own navy we have recently seen the issuance of an order to reduce the charges in all guns using a certain brand of powder, of which extensive shipments had been made to our various vessels.

But that is another story. The erosion, or burning out, of the interior tube of the gun, which is that portion in which the rifling is cut, and which is in immediate contact with the powder gases, is due to the high pressure and intense heat of the powder gases. At the instant that a charge is fired, even in the case of modern, slow-burning powder, a great volume of gas is generated, and being confined in the powder chamber by the projectile, its pressure rises to an enormous figure which, in the case of the service charges in the United States guns, is as high as 17 tons per square inch. This is accompanied by a proportionate rise in the temperature of the gases. If it were possible to look into the powder chamber at the instant of discharge, it would be found to be at a dazzling white heat. As the projectile begins to move down the bore of the gun, these white-hot gases rush out of the powder chamber, and as they stream from the larger chamber into the smaller bore, they literally melt the hardened steel surface of the bore, the process being probably assisted by some chemical reaction not yet thoroughly understood. This erosion is further assisted, and, indeed, perhaps is primarily produced by the imperfect obturation or sealing by the copper rifling band of the space between the projectile and the walls of the gun. The gases, under the enormous pressure, quickly find out the very smallest way of escape past the base of the shell, and they stream at an enormous velocity, and still at a white heat, through any such slight opening, and melt the hard steel of the gun just as a stream of steam or hot water would cut its way through a block of ice.

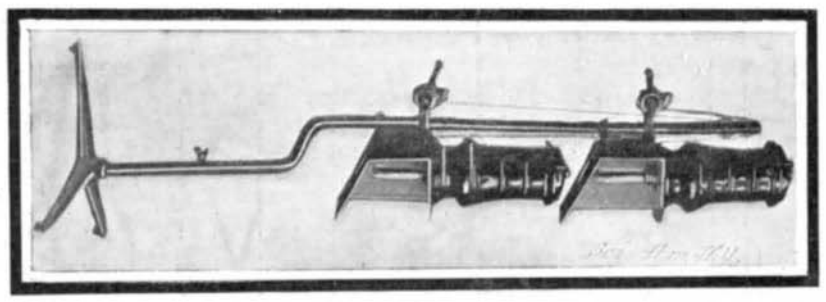
It must not be supposed, however, that all modern guns, after firing 176 rounds, would be in the parlous state of the gun from which the specimen shown in our engraving was taken. This gun was an English piece, and it is well known that the English artillerists have had great trouble from erosion because of the quality of powder which they use. This powder is known as cordite, and the erosion is the price which the English pay for certain desirable qualities which are absent from other powders that do not cause so much erosion. Cordite consists of 58 parts of nitroglycerine, 37 parts guncotton, and 5 parts vaseline, and it is the large amount of nitroglycerine that is responsible for the serious eroding effects mentioned above. Bulk for bulk, the English powder is much more powerful than the United States navy powder; and according to Admiral O'Neil, the late Chief of Ordnance, it requires only about half the weight of the charge for a given gun as compared with the nitro-cellulose powder used in our own guns; consequently, there is a great reduction in the weight of ammunition, and a given number of charges will make a proportionately smaller draft upon the displacement of a vessel, while the individual charges are easier to handle at the guns. On the other hand, with the nitrocellulose powder, the life of the guns is very much longer. Indeed, the erosion trouble has been practically eliminated from the guns of our own navy. The English, however, consider that in view of the advantages of lightness and compactness, it pays in the long run to use a high nitroglycerine powder, and reline guns when they become sufficiently eroded to impair their accuracy. They claim that the operation of relining, as practised in their gun factories, is not such a difficult or tedious operation as might be supposed.

We must confess to feeling a strong prejudice against the use of a powder that commences to destroy the gun from the very commencement of its active service. On the other hand, the Japanese are using the English type of ordnance, and although they have developed a new powder of their own at their home factories, we believe that it is a high-temperature powder of the same general character as the English cordite. The present war should serve to give some very valuable data on this most important subject.

Most of the feldspar used for pottery purposes is orthoclase, or the potash variety, which is found in granite, gneiss, syenite, and mica schist. The basic or lime-soda feldspars are generally associated with dark-colored minerals from which they cannot be easily separated.

NEW PHOTOGRAPHIC LAMP.

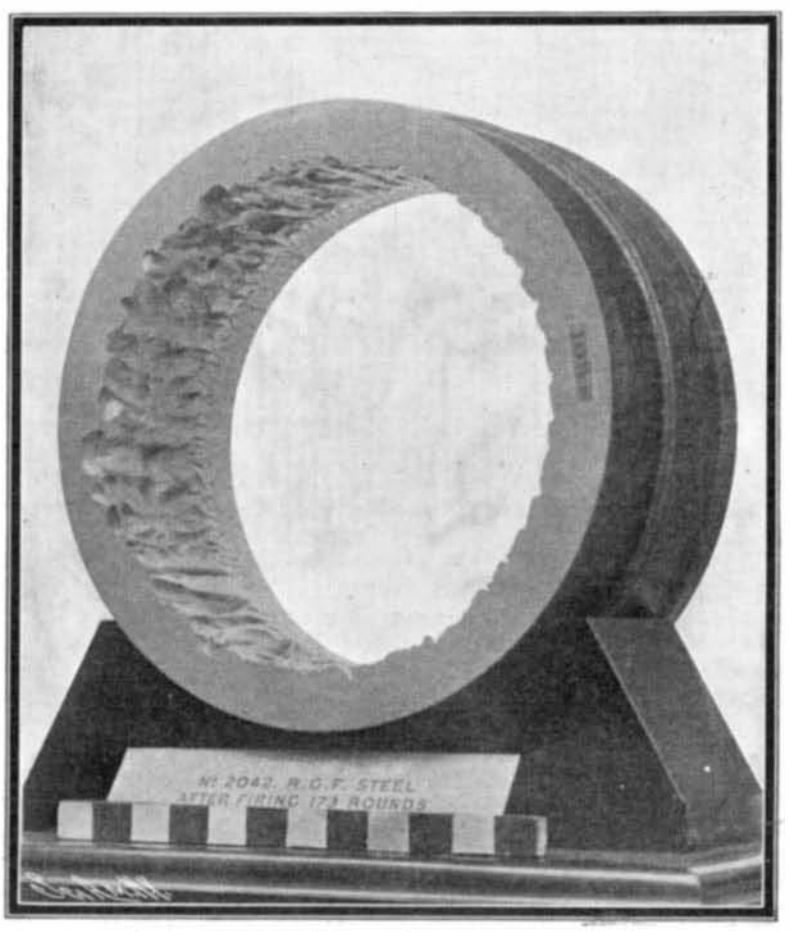
The "Regina" arc-lamp manufactory at Cologne has recently constructed a new type of electric lamp that remedies the manifold inconveniences of the ordinary arc lamps employed for photographic purposes. Of



NEW PHOTOGRAPHIC LAMP.

such inconveniences, one of the least is the production of ashes and poisonous gases. The light given by a single lamp lacks steadiness, thus producing variations in the exposures, and making it necessary to employ several lamps at once. Now, lamps generally consume 40 amperes at 110 volts, and this, in an exposure of 10 minutes, say for a tracing, represents 0.73 kilowatt-hour per lamp and per tracing. Under such circumstances, each copy costs, merely for the exposure, from 20 to 40 cents. With the Regina copying lamp of the latest type, things are different. This apparatus, with the exceptionally long period of 250 hours lighting with a single carbon, permits, through a proper limitation of the entrance of air, of utilizing nearly the whole of the energy in chemically active light. The arc lamp is employed on voltages as high as possible, and the arc has a length of about one inch. There is thus obtained a very great number of active luminous rays. There is evidently a great saving in the current, and the work, it appears, is done five times as quick. With a current of 4 amperes at 220 volts, that is to say, for an energy of 880 watts, the new lamp is, photographically speaking, as efficient as an ordinary arc lamp that consumes 70.4 amperes at 55 volts, or 3,872 watts. According to the experiments that have been made, it requires from 3 to 10 minutes to obtain an excellent copy of a blue print with a consumption of 880 watts. Reckoning the kilowatt-hour at 15 cents, the cost of exposure is reduced to from 1 to 2 cents. The cost would evidently be much less in a private electric installation.

During the contract trials of the new British battleship "Dominion," the latest acquisition to the "King Edward VII." class, a speed of 19½ knots was attained. This is the highest speed that has ever been realized by a vessel designed by the Admiralty when running over a measured course. For this trial the engine room was closed down, all bulkhead doors were closed, the staff in charge was limited to ordinary battleship complement, and every condition was exactly the same as if the ship were actually in action.



Section of Inner Tube of an English Gun, Showing the Erosion by White-Hot Powder Gases.

A BAD CASE OF EROSION.