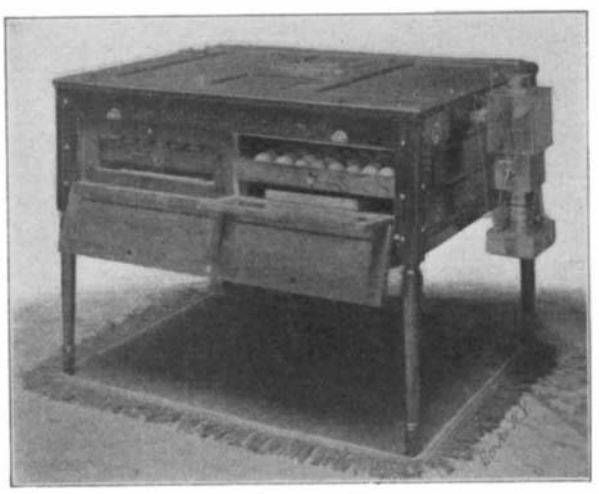
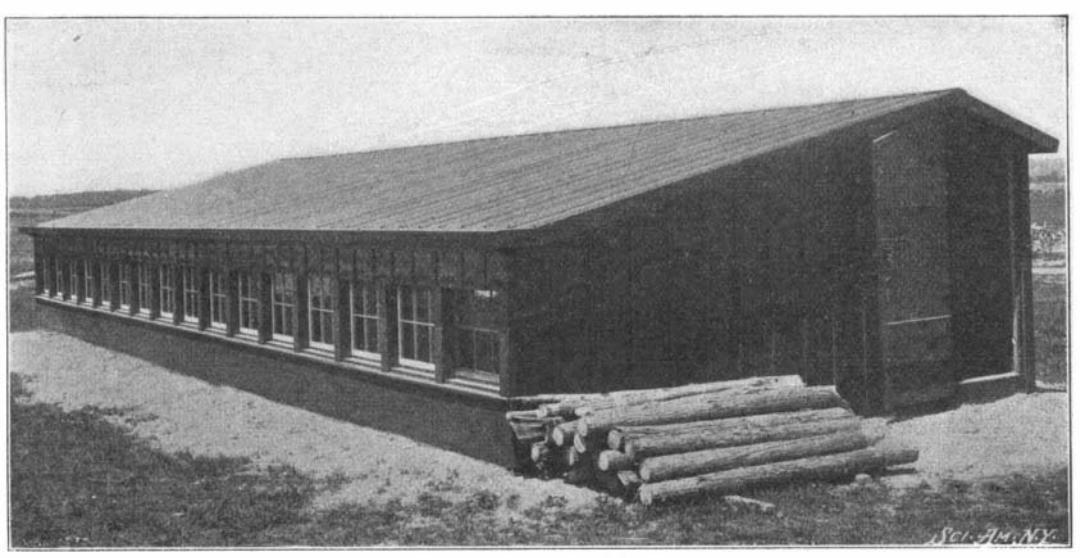
tubing, finally escaping through the pressure gage, as already described. When all the air has been expelled from the cylinder, the cocks at either end of the system are closed. The stops are then adjusted so that the maximum pressure of the water cannot exceed a pressure of 100 pounds per square inch, this precaution being taken to prevent the pressure gage being destroyed, as might possibly otherwise be the case in the event of a greater pressure being exerted. Adjustments completed, a stretch of road is selected for the car to run over for a certain distance, and then back again to the starting point. The return journey is made for the reason that by taking the mean values for the run there and back, it is possible to eliminate the effect of inclines, and thus obtain a perfectly correct result. The load on the car is then augmented and the journey made again, and so on in the same manner, as desired.

The first run was made with a light lorry wheel of 40 inches diameter shod with a 3-inch iron tire mounted on springs of 3 feet 2 inches centers each, with six plates 2¼ inches by 5-16 inch. Three runs were made with this wheel with three loads—3½ hundredweight, 5½ hundredweight, and 8½ hundredweight respectively. The first trial was not attended with any conspicuous success, but another run with exactly the same mountings upon a road paved with sets, the weights being 6 and 8½ hundredweight respectively, at speeds varying from 5 to 14 miles per hour, showed that the tractive effort increased rapidly with the velocity, and at the same time was fairly proportional to the load.

The next experiment was made with a pneumatic wheel measuring 24 inches in diameter by 2¾-inch diameter tires. The springs were exactly the same, but there were only two plates. A macadam road was selected. The run was made with a given load at a constant speed for a distance of about one-half a mile and then back again, the runs being subsequently repeated at speeds of 6½, 8, 10, and 14 miles per hour with loads of 315, 427, 539, and 651 pounds with a leverage of 4 to 1. The result of this test was analogous to the results of Michelin's investigations.



One of the Incubators.



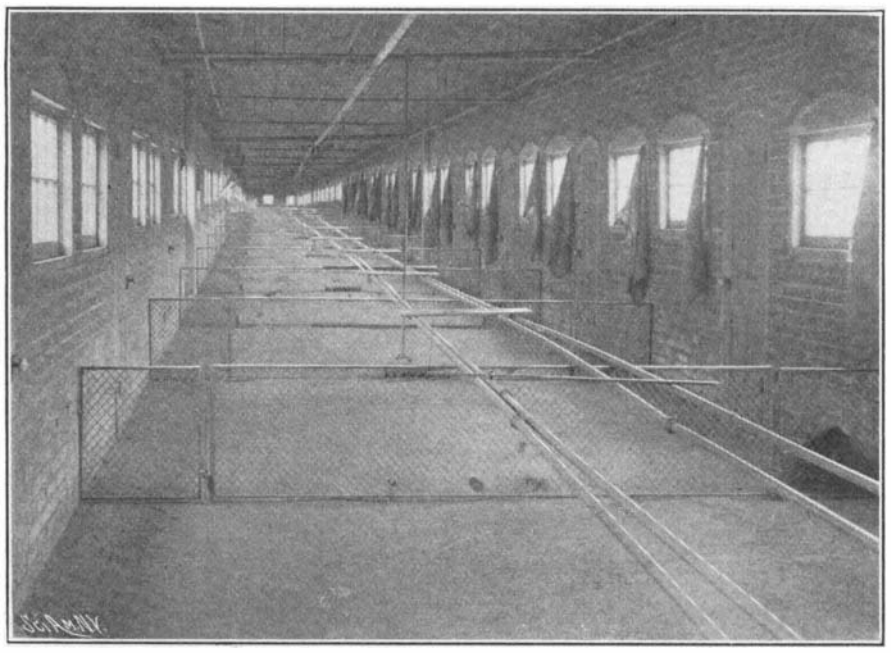
A Modern Poultry House.

The tractive effort was directly proportional to the load, but showed a slight increase with the velocity. Several other experiments of a similar nature have been carried out with highly interesting results. The apparatus works very satisfactorily. The experimental wheel mounted in the castor frame runs very steadily, even under a heavy load and at a high speed. The best-running wheel, however, is the pneumatic-tired, it being found that the lorry wheel oscillates somewhat when running over certain descriptions of roads. The pneumatic cushion is very useful in permitting the recording instrument to work successfully under varying conditions. It prevents the apparatus being subjected to any severe concussions or vibrations, such as might be experienced when running over rough roads, but enables the apparatus to swing gently from side to side. Several further important investigations are to be carried out with the apparatus this year, which it is anticipated will yield valuable information relative to the resistance of road vehicles to traction.

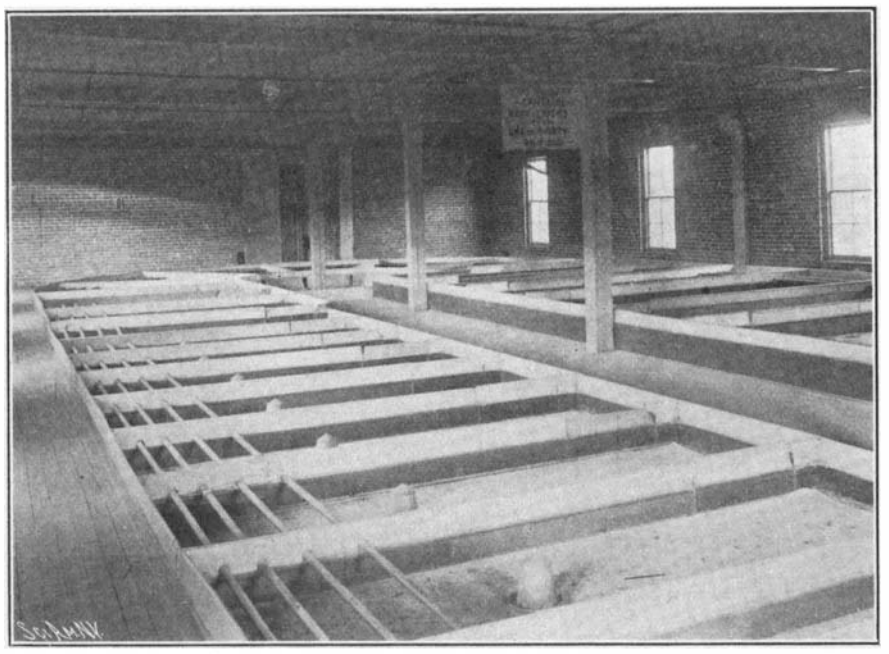
SCIENTIFIC POULTRY RAISING.

The tremendous growth, during recent years, of the poultry and egg industry, which, in point of value of the product, now ranks as one of the leading American wealth-producing activities, has resulted in the introduction of modern scientific methods, which are quite as markedly in contrast to former practices as the advances in any other progressive field of endeavor. Indeed, to present-day achievements in this direction must be attributed the recent development of the American export trade in eggs, which has recently invaded markets as far distant as the Orient.

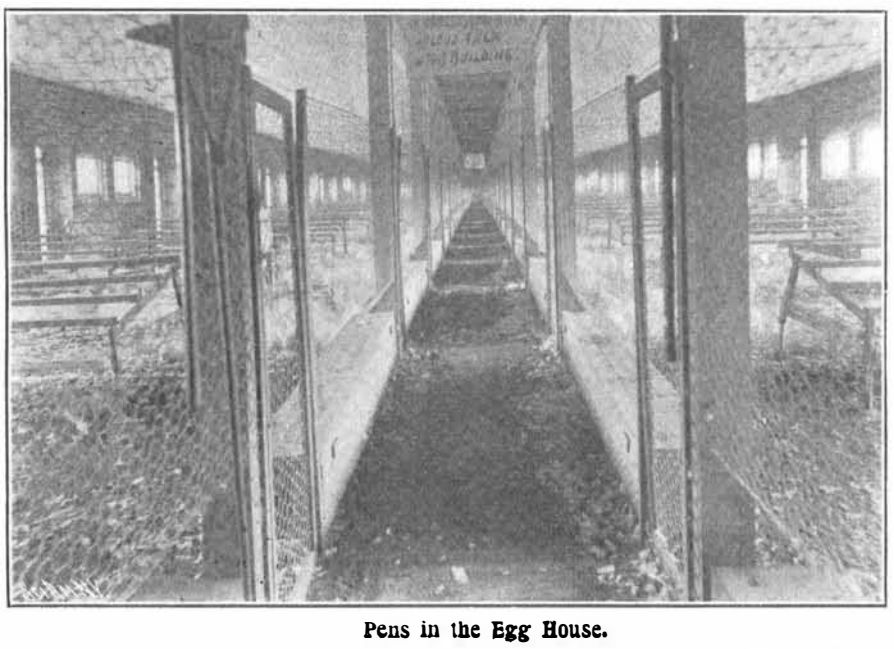
Perhaps the most convincing demonstration of what scientific methods are accomplishing in the poultry industry is afforded by the unique poultry farm at Sidney, Ohio, which ranks as the largest in the



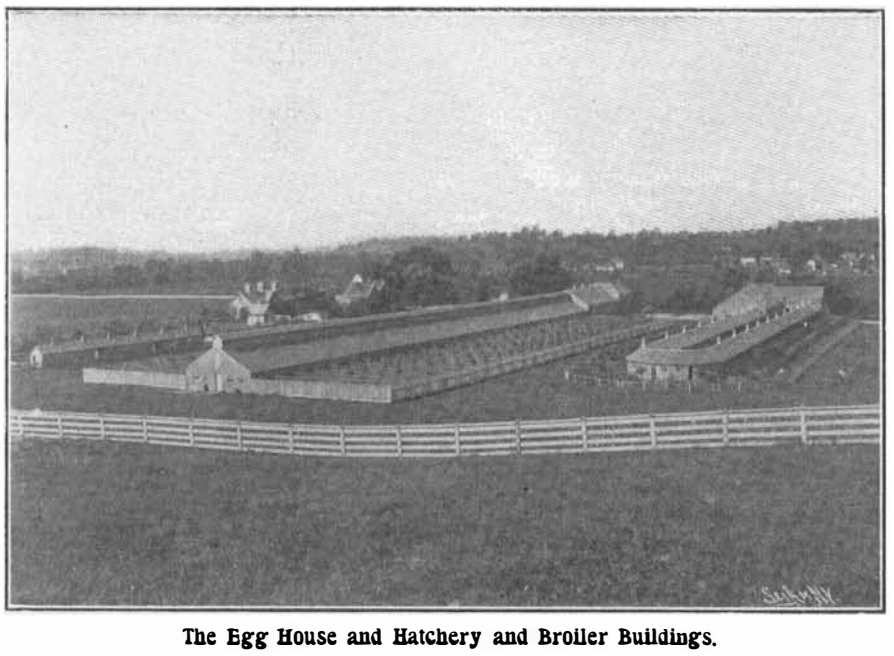
Pens in the Broiler Building.



The Nursery for Newly-Hatched Chicks.



Pens in the Egg House.



The Egg House and Hatchery and Broiler Buildings.

SCIENTIFIC POULTRY RAISING.

United States, and probably in the world. The buildings which comprise the plant consist of two main structures and a number of smaller inclosures. All are of brick construction, with slate roofs; and more than $100,000 has been expended in buildings and equipment, exclusive of the cost of the site, which comprises one hundred and forty acres.

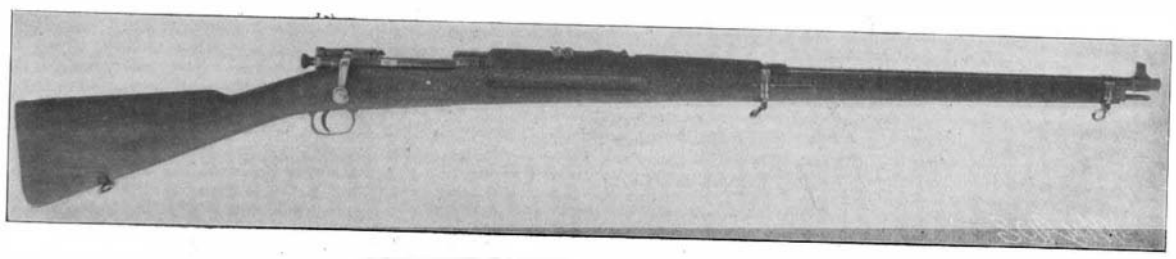
The hatchery, or broiler plant, is 480 feet in length. The main portion of the building is built in the form of the letter U, and has a periphery of 840 feet. In the basement of the other part are thirty incubators, each containing three hundred eggs, so that there is a total of nine thousand eggs daily in a state of incubation. The filling of the machines is so timed that one incubator will discharge its brood each day, and thus the plant may be said to have a daily hatching capacity of three hundred chickens. From the incubator cellar, the small chickens are taken to what is known as the "nursery," which constantly shelters about six thousand young chickens, ranging in age from one to thirty days. When the chickens have attained the age of thirty-one days, they are lowered by an elevator to the ground floor and put in the U-shaped part of the building, which is divided into sixty pens. The chickens advance one pen each day, so that at the end of two months they have completed the circuit and are ready for transference to the shipping department. It may be noted, in this connection, that the U-shaped portion of the building is constantly tenanted by about twenty-one thousand chickens, ranging in age from thirty to ninety days. The egg house at the Sidney plant is 537 feet in length, and similar in construction to the building above described. It is bisected lengthwise by a four-foot aisle, on each side of which are thirty pens containing fifty hens apiece. The three thousand high-grade Leghorn fowls produce daily two hundred dozens of unfertile eggs for culinary purposes. The eggs for the incubators are produced by nine hundred high-grade Plymouth Rock fowls. As indicating the proportion of loss, it may be stated that out of every four hundred and fifty eggs which go into the incubators, an average of three hundred perfect broilers are obtained. Connected with the egg house is an egg washing and marking room, where the date is stamped upon each egg sent to market.

One of the notable advances which have been made by the scientific poultry farmer of the present day is found in the practice of herding chickens. Instead of allowing the hens to run at large as formerly, mingling freely and picking their food from all kinds of refuse, they are now divided into colonies of not more than thirty hens. Each colony has its own reservation, maintained in the highest state of hygienic cleanliness, and each group of hens is separate and isolated at all times from the others. This also facilitates the use of feed calculated to insure the greatest possible productiveness—a subject to which the United States Department of Agriculture, as well as progressive poultrymen, have of late years given great attention; and, as an indication of what has been accomplished in this direction, it may be pointed out that the average yearly yield at these scientific poultry farms is in the neighborhood of two hundred eggs from each hen, whereas under the old conditions the average yearly yield per hen did not exceed forty eggs.

Another advantage of this new policy of segregation is found in the fact that, should a chicken become sick or breed vermin, the trouble cannot spread beyond the one reservation without detection; and thus there is obviated the danger from epidemics such as have frequently in the past resulted in serious loss to poultry raisers. Another new adjunct is found in the automatic nest, which preserves the eggs free from the taint of incubation. No degree of incubation is possible, because, by means of these new nests, the egg is removed immediately after it is laid. The automatic nest has a hole in the bottom, beneath which is a revolving disk that receives the egg as soon as it is laid and moves it away from the nest.

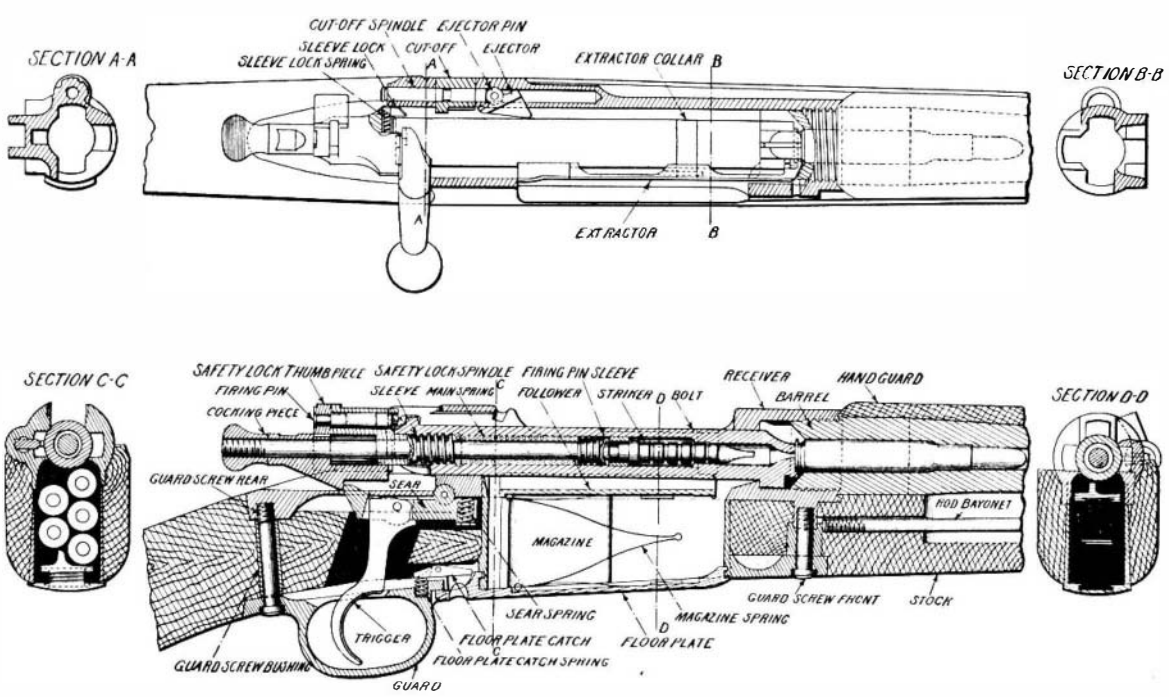
The growth of the poultry business, as conducted on a large scale, could find no more significant criterion than the recent marvelous development of the incubator industry. The center of the incubator manufacturing business is found in the middle West, and one town in Illinois turns out more than fifty thousand incubators every year. It is estimated that not less than five hundred thousand incubators are now in use in the United States. Many of the large poultry farms have incubators with a capacity of one thousand eggs each, and from which there may be hatched ten thousand chickens a year, the loss varying from five to twenty per cent. From a scientific standpoint probably the most interesting incubator plant is that erected by former Vice-President Morton, at Ellerslie, on the Hudson, although ex-President Cleveland has a high-class installation on an experimental farm at Princeton, and President Diaz of Mexico has a costly incubator built especially to his order by an American manufacturer.

Even in the testing of eggs, improvements have been made in the prevailing method. The most effective way of testing an egg is to subject it to the light, but under the old plan, when the egg was held close to the flame of a candle, it almost invariably happened that the shell was blackened. The use of electric light has, however, rendered conditions perfect for a thorough test of the eggs and the utmost speed in handling. A fairly expert tester will examine at least two hundred and fifty eggs a day.



THE NEW SPRINGFIELD ARMY RIFLE.

Muzzle velocity, 2,300 feet per second. Weight of bullet, 220 grains. Weight of charge, 43.3 grains. Weight of gun including bayonet and scabbard, 9.47 pounds.



DETAILS OF THE NEW SPRINGFIELD ARMY RIFLE.

Finally, credit must be given to the new methods of securing speedy transportation for poultry products. Crude "freezers" have been displaced by modern refrigerator cars, and special "dairy trains" now convey eggs from Chicago to New York in less than sixty hours. Even in the event of unexpected delays, no serious loss is entailed, inasmuch as railroads such as the Pennsylvania, which handle much of this traffic, have extensive re-icing plants at various points, where the refrigerator cars are freshly stocked with ice.

THE NEW SPRINGFIELD MAGAZINE RIFLE.

The new Springfield magazine rifle, which has undergone its preliminary tests with very gratifying results, will take the place of the Krag-Jorgensen, which now, for several years, has been doing excellent service in the United States Army. We present a photograph of the gun, which will be known as Springfield Magazine Rifle Model 1902, and also a line drawing which shows several sectional views of the gun. By means of the carefully-lettered parts a good idea is obtained of the details of the gun. The weapon is supplied with a cleaning rod, which can be partially pulled from its place below the barrel, and held with a catch so as to form a bayonet. The great advantage of the rod-bayonet is that it lightens the weight made up of the gun, bayonet, and bayonet's scabbard, and, by dispensing with the latter two as separate articles to carry, permits the soldier to carry with him an intrenching tool of sufficient size and weight to be serviceable. While there is some diversity of opinion as to the value of the rod-bayonet, which is considered to be less effective than the type now in use, it still is of value as converting the musket into a pike. Moreover, in view of the growing value of the intrenching tool and the ever-decreasing opportunities for the use of the bayonet, the substitution of an intrenching tool for the latter is certainly in line with the recent development of field operations. The piece is centrally fed by means of clips, each of which holds five cartridges; and it will be noticed that the bolt has two lugs instead of one as in the old gun. In the last report of the Chief of Ordnance the trials of the piece are spoken of as having given "very satisfactory results." The chief points of difference from the Krag-Jorgensen are this use of two lugs in place of one for holding the bolt against the rearward pressure of the powder—the increased strength so obtained being sufficient to allow of an increase of velocity with the same weight of bullet, from 2,000 feet per second in the Krag-Jorgensen to 2,300 feet per second in the new piece, the resulting increase in muzzle energy being from 1,952 foot-pounds to 2,582 foot-pounds. The Krag-Jorgensen is capable of penetrating 45.8 inches of white pine at a distance of 53 feet, whereas the new weapon penetrates 54.7 inches at the same distance. The striking energy at 1,000 yards has been raised from 396 foot-pounds to 448. Other data regarding the new piece are as follows: The caliber is 0.30; the rifling is made up of four grooves of a depth of 0.004 inch, the twist being one turn in 10 inches. The bullet weighs 220 grains, which is the same as that of the Krag-Jorgensen, but the powder charge has been raised from 37.6 to 43.3 grains. In spite of the considerable increase in its power the weapon has been greatly reduced in weight; for while the present service magazine rifle weighs 10.64 pounds, and the Mauser 10.5 pounds, and the German military rifle 11.54 pounds, the new weapon weighs only 9.47 pounds. It follows, as a matter of course, that, with such high velocity and fairly heavy bullet, the trajectory is correspondingly flat, the maximum ordinate of the 1,000-yard trajectory being only 20.67 feet as against 25.8 feet for the Krag-Jorgensen, 24.47 for the Mauser, and 23.73 for the German military rifle.

In addition to those mentioned above there are other improvements, such as housing of the magazine in the stock directly below the chamber, instead of having it project at the side of the gun, and there are many changes of detail which both improve the rifle and cheapen and accelerate its production.

In closing it should be mentioned that the new gun is considerably shorter than any existing rifle and is only slightly longer than the military carbine.

NEW SPRINGFIELD MAGAZINE RIFLE COMPARED WITH THE KRAG-JORGENSEN, THE MAUSER AND THE GERMAN MILITARY RIFLE.

	Springfield magazine rifle.	Service magazine rifle.	Mauser 7 mm. rifle.	German military rifle.
Caliber .....inches	0.30	0.30	0.275	0.311
Rifling:				
Number of grooves	4	4	4	4
Depth of grooves.....inch	0.004	0.004	0.0049	0.004
Twist, one turn in.....inches	10.	10.	8.66	9.45
Weight of bullet ..... grains	220	220	173	226.82
Weight of charge ... grains	43.3	37.6	38.58	41.2
Weight of complete cartridge, grains	451.15	438.85	385.63	430.24
Initial velocity, feet per second.	2300	2000	2200	2145
Remaining velocity at 1,000 yards.....	958	901	895	906
Muzzle energy .foot-pounds	2581.6	1952	1857.4	2135
Striking energy at 1,000 yards, foot-pounds	447.9	396.2	307.4	413.
Penetration in white pine at 53 feet .....inches	54.7	45.8	50.8	.....
Weight of rifle, including bayonet and scabbard pounds	9.47	10.64	10.5	11.54
Weight of rifle, including bayonet, scabbard and 100 cartridges. . ...pounds	15.91	16 91	16.18	17.68
Capacity of magazine...rounds	5	5	5	5
Maximum ordinate of 1,000 yard trajectory.....feet	20.67	25.8	24.47	23.73