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ARMS AND THE MAN

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ARMS AND THE MAN

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Tests of White-Crossman Rapid Score Systems

By JOHN LYNN

THOSE who harbor a conviction that in these later days when the time comes for practical business shooting, in woods or argument, it usually takes the form of quick snap shots, will be interested in the following tests made last summer to see how accurate that form of shooting might be.

A couple of us were located where shooting could be done practically without limit as to time, ammunition and range. We were planning a trip, moreover, to where there is less shooting and more game. In order that thousand-dollar opportunities at rare big animals might not be fumbled when found, it was desired to polish up whatever marksmanship might be possible, during some months of practice.

The 405 Winchester and the 30–1906 carbine were sighted in to strike exactly where their beads rested at 100 yards on black bull's-eyes. A longer range for the 30–1906 may be more scientific for big game purposes, but the user in this case preferred to have his bullets strike what the Editor of *Arms and the Man* alludes to as the "nail." His name is Bill Richards. He is a toolmaker by trade. He is a graduate of that school of shooting which called every shot a miss that did not "knock down the paper," by "driving the tack," You must understand, however, that this is only his education. It does not bother his real nature much, for he is a natural-born woodsman who can sense a deer or happen onto a bear with astonishing regularity.

The other man is just one of the desk slaves who ordinarily manage to get about ten Saturdays each year for shooting on the range. Judging from previous results of his efforts in the woods, he is a middling to poor shot there. With the military rifle on the range he fires a standard National Match course with an average score of between 260 and 270, which is not so bad, yet never bothers the Marines. His name is Timothy A. Jackson. The character of men and kind of shooting they have been doing is important as a comparison with rapid-fire work to be described.

Bull's-eye shooting was discarded early in the practice because it fails to accustom a man's eye to the looks of his bead on natural, irregular objects. With the several hundreds of shots fired at fake deer and wooden cats this report is not concerned. One day in October, however, as the starting date drew nigh, Timothy quoth to Bill:

"Wonder how our snap-shooting would stack up with the work of certain famous men in Africa—or what they can do on paper."

"Yea, I wonder also," answered Bill. "But we have no way of scoring."

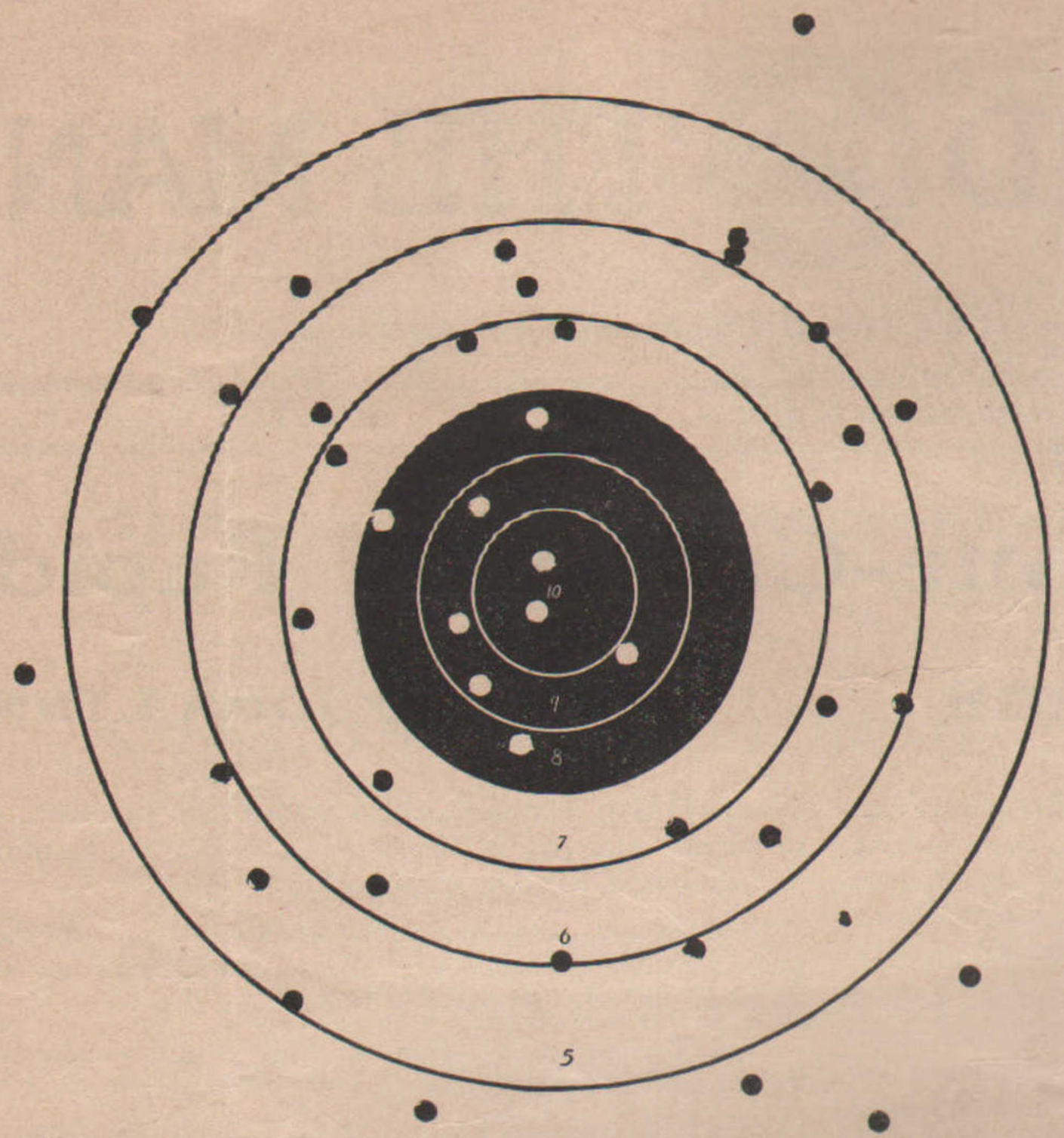
"Didn't Mr. Stewart Edward White work out a system of scoring that is better than that of the military "D" target, several years ago?" Jackson asked.

"Was it Mr. White or Captain Crossman," Bill commented musingly. After some search they located two snap-shoot scoring systems in Colonel Whelen's book, one by White and one by Crossman; the former for single shots, the latter for five-shot strings.

Both employ the standard military "A" target, with 8-inch bull's-eye, but set it up 100 yards away from firing point. With both, the shooter stands ready with rifle stock below elbow and hammer at half cock or safety on. A helper suddenly commands "Fire!" and catches time with a stop-watch. It is up to our marksman then to snap his bullet "there or thereabouts," with as little delay as possible, for the stop-watch is cutting down his score every time it ticks.

The main idea in each of these systems is to reward quick shooting as well as accuracy, while penalizing slowness and wild shooting. For instance, a bull's-eye hit in fastest time given in the table counts three times as many points as the same hit made in slowest time. A four hit counts nearly as much as a bull, on the theory that anyone shooting at game or men is doing some good if he gets a shot into a space 26 inches or so high and wide. Crossman goes farthest in penalizing carelessness by deducting three from total score for every shot outside a 46-inch circle.

As we will need to refer to them in order to understand scores mentioned, both the White and the Crossman tables are included.



Bill's Target

Stewart Edward White System of Rapid-Fire Rifle Practice.

Time seconds for 5 single shots	Bull's-eye counts	4-ring counts	3-ring counts	2-ring counts
20	5	4	3	0
19	6	4	3	0
18	7	4	3	0
17	8	5	4	0
16	9	6	5	0
15	10	6	5	0
14	11	7	6	0
13	12	8	7	0
12	13	8	7	0
11	14	9	8	0
10	15	10	8	0

The Crossman System of Magazine Rapid-Fire Practice.

Time seconds for 5 shot strings	Bull's-eye counts	4-ring counts	3-ring counts
20	5	4	3
19	5	4	3
18	6	5	3
17	6	5	3
16	7	6	3
15	7	6	3
14	8	7	4
13	9	8	4
12	10	9	4
11	11	10	5
10	12	11	6
9	13	12	7
8	14	13	8
7	15	15	9

For every shot which strikes in the 2-ring or every miss, deduct 3 points from the total score.

Timothy and Bill wanted particularly to test their speed in getting off the first shot well, a harder and more important matter than good magazine fire, as every sourdough knows. Jackson fired first, with the idea of using the White single-shot score, but 10 shots were to be fired before inspecting target, and hits numbered from bull's-eye out for convenience.

His time and result were as follows:

Shot	Time *Seconds*	Hit	Score (White)
1st	1½	Bullseye	15
2nd	1¾	"	15
3rd	2½	Four-ring	10
4th	2	"	10
5th	1½	"	10
6th	2½	"	10
7th	1¾	"	10
8th	2	"	10
9th	1¼	"	10
10th	2	Three-ring	8
Total	18¾		108

Military score 41. Total score (White) 108.

After firing this first score of the test, the men discovered that although they had seemed to be wasting lots of time in aiming, the shooting was done faster than the fastest speed allowed for in the White system! White's fastest time for five single shots, as Jackson fired, is 10 seconds, equaling 20 seconds for 10 shots. Jackson's time, however, was 18¾ seconds for his 10 shots. (9½ seconds for his slowest five shots.) Scoring had to be done on basis of 20 seconds.

Bill then fired a string of ten single shots. In order to bring out certain essential truths, his results also are given in detail.

Shot	Time *Seconds*	Hit	Score (White)
1st	2	Bull's-eye	15
2nd	2½	"	15
3rd	1¾	Four-ring	10
4th	1¾	"	10
5th	1	"	10
6th	1½	"	10
7th	1¼	"	10
8th	2	"	10
9th	1½	Three-ring	8
10th	1	"	8
Total	16¼		106

Military score 40. Total score (White) 106.

Bill fired considerably faster than Jackson, cutting two seconds off the latter's time. His accuracy was almost equal to Jackson's, however, as he got only one more three-ring hit, and his fours were bunched closer in. In order better to credit both speed and accuracy, the men then decided to apply the Crossman five-shot magazine string system to their single shot shooting That would give benefit of the 9, 8 and 7 second scoring tacked on at the speedy end of the table.

Crossman scores for shooting already done as described above, when figured up rather changed the totals. Jackson led Bill 108 to 106 before, but now Bill's fast shooting with accuracy gave him 114 to the other man's 107. Bill got 12 points each for his four-ring hits instead of ten, as before, and Jackson 11 points each for his four-ring hits—speed of fire making the difference, according to the tables.

The two targets published herewith are true copies from original ones fired on, except that they are trimmed down to 23 inches square, which cuts off some bullet holes. Each target has had five strings of ten single shots fired at it. That is, each target has had fifty shots. Each ten-shot string was fired on a different day, the project occupying a week or so. Firing was done in sunshine and in rain, at noon and just at twilight, and one string was fired early in the morning.

These composite targets are of course interesting for the scores they show under White and Crossman conditions "crossed," but also will likely prove interesting to show grouping, (or scattering) of fairly speedy snap shots fired by men such as described. Magazine

pages are full of references to what men think they can do or have done in the way of hitting unexpected or disappearing objects, from Military "D" targets to rabbits, but seldom is anything published that shows exactly how well a person will bunch a number of his snap-shot bullets—or how wild they go, as the case may be.

Reading from the notebook, the fifty shots on each target were fired with results shown in the accompanying tables.

It is regretted that detailed scores are too lengthy to include. However, note the following:

One shot in the hundred went out for a two-ring hit. Bill did that trick on Oct. 18th.

The possible score of 50 shots under the Crossman system of scoring is 750. Bill's 532 points is 70%; Jackson's 406 points 54%.

Bill gets his better score almost entirely from speedy shooting. His military score (on accuracy alone) is 201 while Jackson's is 202. These figures, based on use of the "A" target at 100 yards, may be roughly compared to score on "D" target at 200 yards.

The kind of rifles used may have a bearing on the result. A 405 Winchester rifle could not possibly make as small a group at 100 yards as a 30–1906 Winchester carbine, although the difference likely would be only one or two inches. Ten or 15 points should be credited to Jackson on this account.

Twenty or thirty points were dropped by both men in pursuit of a happy thought. It happened thus.

Quoth Timothy Jackson on October 22: "Let us finish up this score in a blaze of glory."

"How so?" asked micrometer Bill. "I've been doing my best."

"Let us slow up our shooting just a second or two, but thereby gain aiming time enough to make all bull's-eyes."

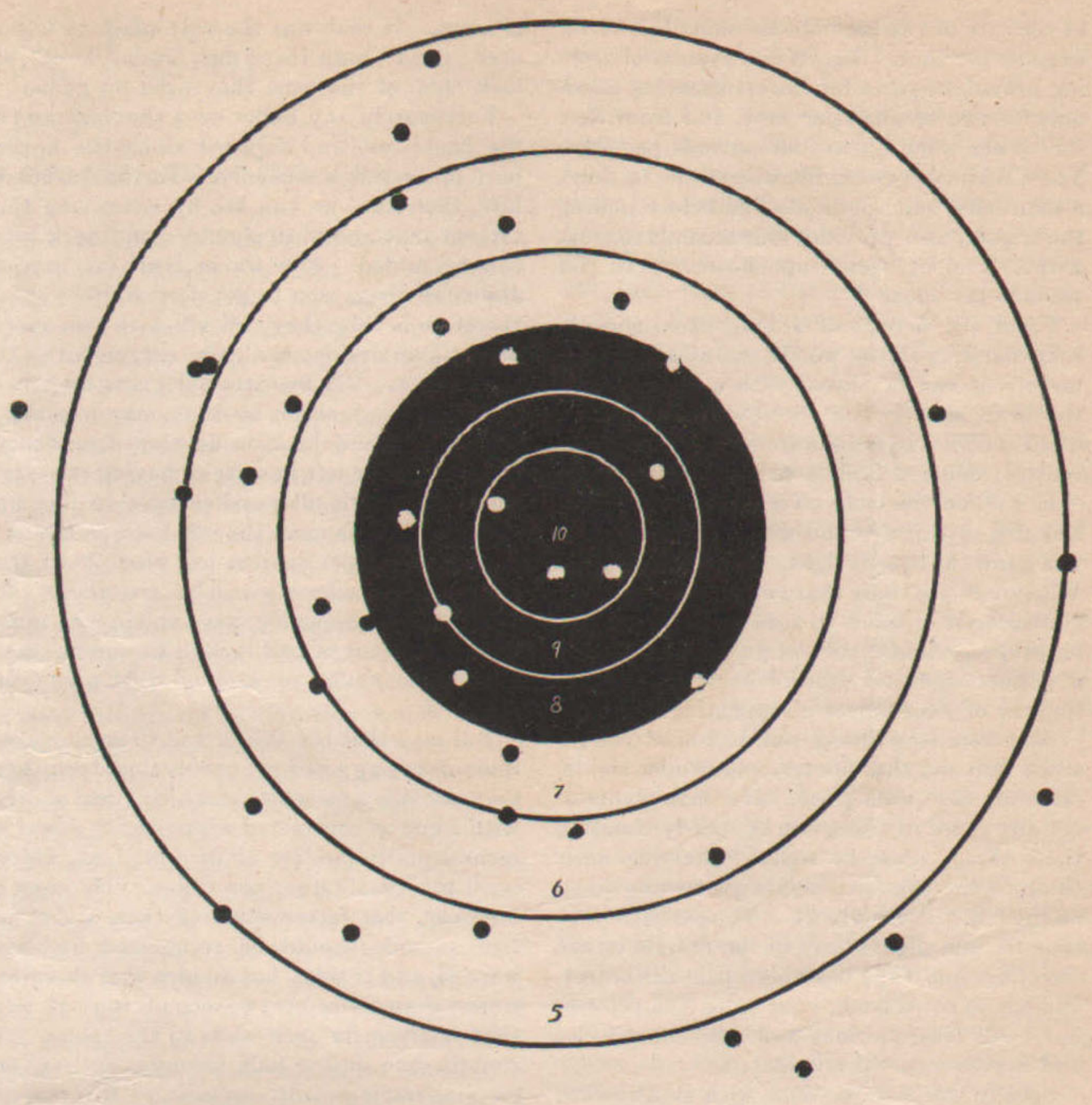
No sooner proposed than tried. As happens to all get-rich-quick schemes, however, an accident spoiled the beauties of this one. As they walked up to the target after shooting, each expecting to see a sort of pepper-box looking bull's-eye, they strained their eyes. When about twenty-five yards away they slowed up, and with five yards yet to go they turned feeble, sheepish grins toward one another.

"I don't see as many holes in my bull's-eye now as there were before I fired this time," acknowledged Bill.

Jackson was wordless.

They simply had not carried out the accuracy part of their aiming intentions, although they took six or seven seconds more time than usual. Billy got only one bull's-eye, with nine four-ring hits; and Jackson two bull's-eyes with six four-ring hits and two bullets in the three ring. Their absolute accuracy was practically no better than with fastest shooting. It seems that a man has a definite shooting gait. If he shoots slower he shoots poorer. Reference to the Crossman table shows that had they made *all bull's-eyes* at same speed their scores for this string would have been only about 100.

In spite of this waste of time, Bill's total time for 50 shots is only 89 seconds and Jackson's only 99 seconds. That is, Jackson fires



Jackson's Target

Date	Time Bill *Seconds*	Time Jackson *Seconds*	Score (Crossman table) Bill	Score (Crossman table) Jackson	Military Scores Bill	Military Scores Jackson
Oct. 14, 10 shots	16¼	18¼	114	107	40	41
Oct. 17, 10 shots	16¼	17	106	121	39	41
Oct. 18, 10 shots	17¾	19	102	93	38	39
Oct. 20, 10 shots	16½	19	119	111	42	40
Oct. 22, 10 shots	22¼	25¾	91	74	42	41
Totals	89	99	532	406	201	202

COMPARATIVE CAST BULLET ACCURACY

Bullet	Weight grains	Powder charge grains	Average 10 shot groups M. E. R. 100 yards. Newton inches	Springfield inches	Remarks
Ideal No. 311243	154	12 of Schutzen	3	2.8	Good Load
Ideal No. 311243	154	11 of Schutzen	3.4	3.	Good load.
Ideal No. 311243	154	9 of Schutzen	4.	3.1	Light-uniform.
Ideal No. 311243	154	8 of Schutzen	5.5	4.2	Too light.
Ideal No. 311243	154	12 of DuP No. 75	6.	4.3	
Ideal No. 311243	154	10 of DuP No. 75	5.7	4.2	
Ideal No. 311243	154	8 of DuP No. 75	4.6	4.1	
Ideal No. 311243	154	14 of DuP No. 80	6.8	5.2	Poor balance.
Ideal No. 311243	154	10.5 of DuP No. 80	4.5	4.1	
Ideal No. 311243	154	8.5 of DuP No. 80	5.4	5.	
Ideal No. 311243	154	6.5 of R. S. Q.	3.6	3.	
Ideal No. 311243	154	4.5 of R. S. Q.	8.	7.2	Too light.
			25 yards		
Ideal Factory	77	2 of Bullseye	1.4	0.9	
Ideal Factory	77	2 of Unique	1.	0.7	
Ideal Factory	77	2 of DuP Shotgun	.....	.....	Irregular.
Ideal Factory	77	2 of Ballistite	1.1	0.8	
Ideal Factory	77	2 of DuP No. 75	1.2	0.9	
Ideal Factory	77	2 of No. 3 Pistol	1.7	1.	

at the rate of two seconds per shot: Bill at 1.8 seconds per shot. The White system of scoring provides figures for fastest shooting down only to two seconds per shot, and from that for slower work up to four seconds per shot. The Crossman system likewise seems to think a man may wait round a while before pulling the trigger, as it provides four seconds to start with. It does speed up, however, to 1.4 seconds per shot.

From the depths of a long experience in snap-shooting in the woods and at all sorts of targets, it can be stated with authority that the dead shot is the speedy one. That is, quickly delivered bullets are more like to strike centers; delayed bullets to strike somewhere else. When you snap off a shot, in "earnest" shooting, within a second or so you do it because you know the bead is right. Why wait longer? Wild shots are those that you take upwards of two seconds or more to aim, and still are not on properly, and finally let go without getting a perfect sight for fear of overstaying time limit or of your object disappearing.

And here is where a well-balanced rifle, a stock that fits the shooter, and proper sights, certainly earn their price. If a man wants to get anywhere in this game of speedy shooting these things must be right. The rifle must come to the eye with sights practically lined on the bull's-eye or object. You perhaps have time for one slight shove of the muzzle in one direction, but if the bead bobs past the object, and has to come back, your score is hopelessly low. All false motions and slack in muscles and nerves must be eliminated.

Speedy work can be done with an awkward combination like the Springfield Military rifle as issued, but that requires a great deal more skill than to accomplish equal scores with a rifle that fits all round. More than that, it requires almost daily shooting to keep the shooting muscles sufficiently hardened and trained.

The one-gun man is right in his element in this game. He gets used to one stock, one weight and balance, one trigger pull and one appearance of sights. After a while he does almost automatically, almost by reflex or involuntary muscle and nerve action, what the several-gun man must accomplish by mental concentration and muscular strain. He can load far quicker, he can slip off the safety or cock the hammer with greater dexterity, and he has a command of the one gun in aiming that no one can have over several guns.

It is interesting to compare these 50-shot composite groups with the size of deer—remembering the range was 100 yards. A deer's body is well up to 15 inches deep, belly to back. A 15-inch strip through the center of either target takes in about 35 of the holes. Bill and Jackson therefore will get hair and blood at 100 yards with 70% of their shots, and will miss altogether with 30% of their shots unless they accidentally strike a leg or head.

But a good many of their 70% of hits will merely wound. To kill require a hit in a vital spot like heart, shoulder or spine. An eight-inch circular area about the heart usually is considered fatal. Bill has 10 bull's-eyes, and Jackson nine. They will strike their deer, therefore, with one shot in five, 20% of their chances. If that was the only place to kill a deer "dead" both these men would be out of luck 80% of the time they fired on game.

Fortunately any bullet on a shoulder up to the backbone, and forward along the upper part of neck is a sickener. To the 10 heart hits, therefore, we can see by examining the targets that about 10 shoulder and neck hits can be added. The whole truth as to the ability of these men to get deer at 100 yards, therefore is this: they will kill with two shots out of five, and let the game escape with the other three. Bill, by extra quickness, may do a little better. Jackson, by delay, may do poorer.

Both Bill and Jackson developed tendency to shoot to the left in spite of having targeted their rifles with all possible care to line up sights. Bill has more than 30 holes in the left half of his target against less than 20 in the right half. Jackson's results are about the same. This happening may explain why some of us have runs of bad luck in business shooting while our rifles show up all right whenever targeted

Bill says that the White and Crossman systems of scoring rapid fire are invaluable in that they provide a means of measuring real ability with a gun as contrasted with guaging a man's mental understanding of its functions, which is all the usual target score does. He insists, however, that faster shooting than a shot in two seconds should be recognized and rewarded, and besides, has an idea that shooting slower than a shot per two seconds is worth less than is given for such shots in the tables. A shot in one and a half seconds, or less, he emphasizes, is usually successful. It is practical shooting. The one second shot is better, of course, but not greatly better. And he offers this table as an improvement on the White table of scores, with the possibility of it also working well for magazine rapid fire, thus doing away with two different scoring tables.

Scoring Table for 100-yard Snap Shooting, for Single Timed Shots and Magazine Timed Fire. (Military "A" Target).

Total time 5 shots *Seconds*	Bull's-eye counts	4-ring counts	3-ring counts
20	1	minus 1	minus 8
19	2	Net 0	minus 7
18	3	plus 1	minus 6
17	4	2	minus 5
16	5	3	minus 4
15	6	4	minus 3
14	7	5	minus 2
13	8	6	minus 1
12	9	7	net 0
11	11	9	plus 1
10	13	11	2
9	15	13	3
8	17	15	4
7	18	16	5
6	19	17	6
5	20	18	7

For every bullet that strikes outside 3-ring deduct 10 points from total score.

The shooting done by Bill and Jackson would score as follows under this system: Possible for 10 shots is 200 points; for 50 shots, 1000 points, making percentage computation easy.

Date	Bill	Jackson
October 14th	125	98
October 17th	105	132
October 18th	102	84
October 20th	129	111
October 22nd	72	48
Totals	533	473

Bill's average is therefore 53% and Jackson's 47%, which represents quite a reduction from former percentages. Under this system wild shots and slow shooting cut heavily into the score, even as they would cut down a bag of game or enable the enemy to kill more of our soldiers on a battlefield. Under this system, also, the margin of credit for merely wounding game is cut down, which is an extremely proper thing to do.

The .250-3000 Savage on Big Game

By ALLYN H. TEDMON

SOME time ago the Editors of *Arms and the Man* gave a list of the things that they would like some dope on. Among them was a request for information on the Savage .250-3000 on big game. As apparently no one has taken the trouble to write down this information I, with some hesitation, add my mite to what might be said by others far more ably prepared. I obtained one of the first, if not the first, 250 Savage that came into the Wyoming Big Horn Country. That was in April 1915. This rifle has for the most part been used on coyotes and with reduced charges, it has part of one elk to its credit; part I say for two of us hit it. However, I have met many others using this style of arm and will give from them instances of its use on big game. In my own case the elk was a big yearling. The .250 hit it under the femur, ranged up and forward and vanished under the loin side. It just missed the back bone. At about the same instant it was hit in the chest with a .35 Remington, the bullet cutting heart and lodging in the intercostal muscles on the opposite side. So far as we could see the bullet from the .250 showed more penetration than that from the .35. The former having to pass through the heavy muscles of the part, while the latter had only the chest cavity to penetrate. The .250 made a small hole on entrance but then opened out into a canal nearly two inches in diameter which if I recall rightly extended at least 15 inches through the heavy muscles; no part of the bullet was ever found. A friend shot an

(*Continued on page 9*)

Revolver vs. Pistol

By Major S. J. FORT

Former Chief Instructor, Pistol, Small Arms Firing School, Camp Perry.

THE PISTOL under consideration is the Model 1911. The revolver, any of the tribe of .38 up to .45 calibre, which have been used for military purposes, or target shooting, or both.

The revolver invented by Colt in 1835, rose to importance as a hand-gun and history-maker between that date and 1845, when it was authorized as a service weapon, demonstrated its accuracy as a target shooting weapon in 1888, reached the zenith of its fame and was discarded in 1911 in favor of the self-loading or so-called automatic pistol of .45 calibre.

A temporary recrudescence in 1918 brought out a .45 Smith & Wesson revolver which with its colleague, the Colt revolver of the same calibre was intended to supplement a possible deficiency in the numbers of automatic pistols. It may be said in passing that these revolvers offer most reliable and accurate weapons to those who desire one of this calibre.

Up to 1918, it is doubtful if many of the old-timers, well acquainted with the revolver, did more than accept the automatic pistol as a matter of necessity. The student officers ordered to the Camp Perry Small Arms Firing School during this year, many of whom were totally ignorant of firearms, and even those who knew something of the art of shooting, did not at first take their instruction seriously, but merely accepted it as part of the day's work. It speaks well for the course of instruction in pistol firing adopted at the school, that it soon developed an interest which never waned.

It was a common occurrence with each succeeding class to have one or more of the older officers state that "no one could shoot the d—— thing straight," but after these "doubting Thomases" saw Captain LeBoutellier or Lieutenant Dietz demonstrate to the contrary, this opinion was changed.

Not infrequently, students, especially cavalry officers, after making a poor score with the pistol would remark, "if I only had a verolver I could do better shooting," at which time the aforesaid student would be given what he wanted and urged to demonstrate. Sometimes, and while shooting with deliberate aim, better scores would be made, but generally speaking there was little difference, for as far as could be determined by questioning, very few of the officers coming to the school, whatever their rank or term of service, had received much if any instruction in the use of the hand-gun.

An experiment was made with one class, requiring each student to fire five shots, deliberate aim and five shots rapid fire, first with the revolver and then with the automatic pistol at fifteen yards. Comparison of the scores made, showed a point or two in favor of the revolver for the deliberate aim firing, probably due to the smoother and lighter trigger pull of the revolver but for the rapid fire, the advantage was all with the pistol even though the firing was conducted without giving any more instruction than was necessary to prevent accidents.

As a strictly target weapon, the revolver even with military sights has been proven an exceptionally accurate weapon at fifty yards, while the automatic pistol at this distance developed peculiarities which made it difficult to keep a series of hits in the bull and 4-ring of the "L" target especially when shooting five shots in thirty seconds, for which reason the Expert Test of the pistol qualification course has proven something of a gamble, even the most expert shots failing at times to make the required 80%. Once at Perry, after firing a class through its qualification course several of the instructors lined up at the targets and fired the Expert Test and if I remember correctly, the highest total scored was a 39 out of the possible 50.

In contradistinction to this unhappy occurrence, during a match held between the instructors of the school, the conditions calling for fifteen shots at fifty yards on the "L" target, Colonel Mumma, the Commandant of the school, rapped out a total of 133 points of an average of 80.8%. The Colonel fired his score as required with deliberate aim, but a little later Lieutenant Dietz made the same total, firing each string of five shots in less than thirty seconds.

The results of the course of instruction with pistol as carried out at Perry and given to several thousand officers, proved conclusively that the Model 1911 pistol was a very accurate weapon up to 25 yards and also that with such a course, men could be taught in a relatively short time to use it effectively. At the time it must be granted that had the same intensive training been given with the revolver, the results would have been much the same as with the pistol. The chief point of superiority of the latter over the revolver being its rapidity of fire without further manipulation of its mechanism than required to start shooting.

The National Matches of 1919 offered an exceptional opportunity to test this matter between the two weapons, for the conditions established at these matches permitted revolvers of any calibre from .38 to .45, with or without target sights, as well as the regulation Model 1911 pistol.

Unfortunately there was no record made to show how many used revolvers, though Captain Crossman, Chief Range officer, states that the weapons used included everything from the pocket models of .38 calibre up to the heavy black powder .45 calibre "smoke wagons," along with the automatic pistol, some going so far as to use their revolvers for firing slow fire stage, but switching over to the automatic for the rapid fire stages.

Before taking up the scores of the 1919 matches with the pistol, it may be interesting to look over those made in 1918, which were shot at Perry under the usual conditions, the the Model 1911 pistol with a six-pound pull being required.

The N.R.A. Individual Pistol Match was won by Captain Thomas LeBoutellier, at that time an instructor in the school, and at all times a competitor to be reckoned with. LeBoutellier scored a total of 288, Gettys, of the Wyoming team took second place with 281; with Hall, of California, third on a total of 273. Frank Parmely, who later won the National Match, got nineteenth place with a total of 260.

Taking seventy-two of the highest totals as a comparison, this being the number of medal winners in the National Match, the highest was 288, lowest 241. The high score for the slow fire stage was 99, timed fire, 96, and rapid fire 94, all three scores going to the winner.

Parmely shot in one of the later relays of the National Pistol Match (after Sergeant Cox of the Marine Corps had nosed Rumsey out of what looked like first place, by one point and a total of 280), putting over a total of 285 which was proved to be the top score. The lowest total of the 72 medallists was 252.

For slow fire, 99 was high, 98 for timed fire, and 91 for rapid fire.

Lieutenant Christofferson, who turned up the winner in 1919, shot in both of the above matches, taking sixth place in the N.R.A., with 270 and twenty-fifth place in the National with 265.

The scene now changes to Caldwell, N. J., where the 1919 matches were staged and as before stated, with the gate wide open to let in the revolver experts, with the following results.

With every opportunity to show its supremacy, the revolver seems to have been lost in the shuffle, so far as can be determined by the evidence at hand, the Model 1911 carrying off every possible honor, incidentally establishing a record total for the National Match course under strictly match conditions.

Mr. A. P. Lane, one-time Olympic Champion, made a wonderful "come-back" after being out of the game for some time, and won the N.R.A. Individual with the record score, at that time, of 293 out of the possible 300. Bayles of Connecticut, took second place with 286, and LeBoutellier was third with 285.

High score slow fire, 99; timed fire, 99; rapid fire, 96.

Of the three medal winners in this match, Lane and LeBoutellier are known to have used the Model 1911 pistol. Bayles is widely known as an expert revolver shot and may have used one at this time.

Shooting as a member of the Greenwich Rifle Club, in the N.R.A. pistol team match, Lane topped his record total of 293 by one point, shooting over the National course, and also put over a possible for the slow fire stage, the first on record.

Lieutenant Christofferson won the National Individual Match with a total of 292, Lane being runner-up with 288. The lowest total of the 72 medal winners was 266. Christofferson and Hall of California, both hung up a possible for the slow fire stage, and Spooner

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ARMS AND THE MAN

1111 Woodward Building, Washington, D. C.

SEMI-MONTHLY—ON THE 1st AND 15th DAY

Editor

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KENDRICK SCOFIELD

Entered as second-class matter, April 1, 1908, at the post-office at Washington, D. C., under the Act of Congress of March 3, 1879.

That a man shall serve his country in time of war is noble, brave and patriotic; but that a man shall properly prepare himself in time of peace to serve in war is all of these things and more. It is noble with a nobility which is real, not ideal. It is brave with a bravery which assumes in time of unemotional peace many burdens, among them that of bearing the lack of appreciation of those who do not consider military preparation or training necessary.

THE POSSIBILITIES OF THE SMALL-BORE

AS THE result of this year's N.R.A. Gallery competitions it is up to a good many doubters to revise their opinions as to the accuracy possibilities of .22 calibre rifles and ammunition when the men doing the shooting are skilled shots.

Glancing over the individual averages, as shown in the statistics on which were awarded 90 percent medals, it will be seen that two men—members of civilian clubs—are officially credited with having dropped only one point during the entire series of ten matches; this means an individual average of 199.9 points out of a possible 200 points in each match, and a percentage of 99.905 percent. Of those whose scores were 99 percent perfect or better there were 62 among the Civilian clubs; 2 among the Colleges; 5 among the Military Schools and 3 among the high schools. The names on the 90 percent list ran into the hundreds. Never have either such individual or club records been recorded in the history of N.R.A. small-bore shooting.

The high scores in the gallery matches were not confined to any one locality, a geographical list of the men averaging 199 points or better for every match in the series of ten showing shooters from the far west, the Atlantic seaboard states, the middle west, the far south and the New England States.

All of this argues well for the future of the small-bore rifle as a target weapon worthy of serious consideration. Although all of this shooting was done on indoor galleries under artificial light, the results demonstrate that if anything, the shooting public has underestimated the possibilities of small-bore rifles and ammunition. With records such as these to point to, it will not be difficult to convince the members of the shooting fraternity, both old and new, that the .22 calibre target arm and high class .22 calibre cartridges are a combination which contains much hitherto undreamed of in their philosophy. With the fact established that this combination will shoot better than the average good rifleman can hold, it will be only a step to awakening a lively and healthful interest in the possibilities of the small-bore. This conclusion finds ample support in the attitude of a score of old timers who virtually forsook the service firing line for the small-bore range at Caldwell last summer.

It is far from a fair assumption that on the outdoor range, the .22 calibre bullet can be made to behave with the accuracy that it is capable of indoors; there are to be considered the intrusion of other elements—increased range, windage and elevation. But an accuracy in ratio to that shown in the gallery competitions, subject of course to the effects of wind, trajectory and greater range, may confidently be expected.

National Match Plans Take Shape

THE National Matches of 1920 have begun to take definite shape. Maj. Morton C. Mumma, Executive Officer, who started the National Match machinery moving several weeks ago, not only has taken steps to insure the success of the meeting of riflemen after they report at the Camp Perry Range, but has in hand already replies from various Adjutants General which indicate that more than a score of National Guard and Civilian teams are even now in process of formation. The number of these teams will naturally be greatly augmented as the time for the matches approaches, the last hour entries always exceeding the number of those reported well in advance of the events..

Not only are the state teams getting busy, but the captains of three of the service teams have been announced. They are: Maj. C. B. Matthews, United States Marine Corps, Capt. Ned. M. Green, United States Infantry, and Capt. J. J. O'Hara, United States Cavalry. All are old timers in the shooting game, members of former National Match teams, and Capt. O'Hara was with Clopton's 1913 champions.

Replies from these states show the following representation already determined upon: Arkansas, Civilian Team; Illinois, National Guard and Civilian; New York, National Guard and Civilian; South Carolina, National Guard and Civilian; Georgia, National Guard and Civilian; South Dakota, National Guard and Civilian; Ohio, National Guard and Civilian. In addition to these, word has been received that a team to represent the Philippine Constabulary will be authorized, as well as a team from each of the R.O.T.C. camps. There is little question but what the attendance at the 1920 matches will be entirely up to standard and it is only a question of time until practically all of the classes of competitors will be represented.

It is thought that the Infantry and the Cavalry Teams may train at Camp Perry. The Marine Corps team will train at Quantico until the middle of June at which time a training camp will be established on the Wakefield, Massachusetts, Range. The Marine Corps will send only one team to Perry this year, and that team will include both riflemen and hand-gun experts. Two coaches will accompany the team, one to work with the rifle team and the other for the pistol team. The coaches have not yet been designated.

Maj. Mumma expects to have at Camp Perry a corps of Assistant Executive Officers, Range Officers and other officials who are thoroughly familiar with the operation of the big range on Lake Erie; in fact most of the match officials upon whom will devlove the details of range operation either are graduates of the Small Arms Firing School which was conducted at Perry during the war, or are former members of the Small Arms Firing School staff. Lt. Col. Smith W. Brookhart, of Iowa, who was Major Mumma's right hand man in the Firing School, will probably be designated Assistant Executive Officer and will be placed in charge of the school of instruction which will precede the National Matches. He has already been order to an active duty status from the reserve, together with others, including Maj. Frank Maloney, and Maj. L. M. Rumsey. These officers, either in or out of the service at the present

time, will in all likelihood be present at Camp Perry in charge of different National Match features: Maj. A. B. Critchfield of Ohio; Capt. C. J. Van Amburgh of Connecticut; Capt. E. C. Crossman of California, Capt. G. L. Wotkyns of California; Capt. C. W. Linder, of California; Capt. Carl D. Loos of Illinois; Capt. H. L. Harker of Maryland; Capt. Glen Van Auken of Indianapolis; Capt. W. Z. Roll of Ohio; Capt. C. B. Chisholm of Cleveland; Capt. R. W. Alderman of Washington, D. C.; Capt. J. M. H. Wallace of New York; Capt. Don A. Preussner of Iowa; Captain Basil Middleton of Indiana; Capt. A. E. Clark of Minnesota; Capt. W. F. Leushner, of New York; Captain A. D. Rothrock of Ohio; Capt. James H. Keough of Massachusetts; Lt. John H. Cole of Washington, D. C.; Lt. V. L. Clear of Indiana and Lt. Perry S. Schofield of Massachusetts.

REVOLVER vs. PISTOL

(*Concluded from page 7*)

of the A.E.F. team punched out another for the timed fire stage and 96 was high for the rapid-fire.

As an incident of rare sportsmanship, Mr. Lane tuned up the pistol used by Lieutenant Christofferson for the big match and as a reward for his "good Samaritan" act; had to be content with second place in the contest for which he was slated as an almost sure winner.

In passing it may be stated that Mr. Fitzgerald, the gentleman who tests pistols for the Colt people, quite recently put over a possible for each stage of the National Pistol Match course, which is a straw pointing to the possibility of the same thing occurring again under strictly match conditions.

This recapitulation of past history is not meant to force a conclusion as to the relative accuracy of the revolver as compared to the automatic pistol. The evidence at hand is by no means conclusive, though the wonderful scores made last year with the latter weapon have never been equalled by the former, each being shot under the same conditions and in many cases, by the same men.

It is disappointing that when the opportunity occurred, more of the revolver experts did not take advantage of it and that better records of the number of revolvers etc., was not kept. This chance will probably never happen again, for the Model 1911 has proven its advantages and until some other and better model of hand-gun is invented, will likely remain the service side-arm for an indefinite period.

The staying qualities of the regulation automatic pistol was well demonstrated at the Small Arms Firing School, where fifty were in constant use during the life of that school, over 300,000 cartridges being fired through them with no apparent effect upon their accuracy and remarkably small breakage of parts.

The final reports of those used over-seas has not yet appeared but certainly few complaints of the effects of service conditions have filtered through, from those in the know. Enough has been written to show that up to 25 yards its accuracy is quite up to anyone's ability to hold it and that as a rapid fire weapon it has few superiors.

For the matches of 1920 the conditions are again changed, a 50-yard slow fire stage taking the place of the former slow fire stage at 25 yards. There will also be a National Pistol Team Match, and the N.R.A. will duplicate these events as usual, under the same conditions.

The weapon to be used is the Model 1911, and a trigger pull of not less than four pounds is permitted, sights as issued.

Under existing conditions it is probably wise to put on the 50-yard distance, even though the 5-inch bull of the "L" target is none too large for accurate sighting. Reduction of the trigger pull, to 4 pounds removes one of the worst handicaps of the pistol, for accurate target shooting at the longer distance where slight deviations of hits at shorter ranges are magnified more than double. Shooting at this range with a thirty second limit per shot is practically deliberate aim, and the data accumulated should prove interesting and let up hope will demonstrate that Model 1911 is a sure enough target weapon as well as an effective arm for war shooting.

It was proven at Benning last Spring, that the Model 1911 with a loose slide **cannot** make a reliable score at 50 yards, and this factor up to that time unrecognized, has probably been the cause of so many failures to make the expert test. "Gloomy Gus" Linder is the only expert I have ever heard claim a five-shot possible at this distance and as he is perfectly capable of turning the trick it can be accepted as true. LeBoutellier and "Dad" Raymond, while at Perry, scored 48 several times, shooting with deliberate aim, but this is only what might be expected from experts who infested the targets at every opportunity. Any good shot who shoots often enough can bag high scores at intervals, but after all it is the average of such shooting that counts when predicating competitive results.

At any rate, those who expect to be present at Perry this summer might remember the suggestion about their pistol slides and have their trigger pulls reduced before beginning practice, always remembering that if fined down too close to the minimum, it may let down beyond it, at a critical period.

THE 250-3000 ON GAME

(*Continued from page 6*)

elk at around 200 yards with a .250 hitting it in the chest, the bullet penetrated the chest and either lodged in the heart or passed through it; I saw this bullet. It was in quite good shape and had held together well. The distance had so lessened the velocity that it did not go to pieces as usual at shorter ranges. Another friend, since passed to the great beyond, being with the Biological Survey, had an opportunity to use, and see used by his trappers, numbers of these little rifles. He himself shot several elk with one. In one instance he placed two shots in the chest and had no trouble in landing his elk. At another he shot at a big bull from high up on a ledge, the band of elk running down the mountain below him. He hit it twice I believe in the back, and while the bullet didn't penetrate through the bone, it scooped out a large amount of meat and knocked the elk clean off its feet and he killed it with other shots. One of his trappers killed elk and bear with one of the rifles. In one instance, I remember of his telling me, the elk was hit in the head from behind; of course it was a dead elk. This trapper was an exeptionally good shot and made such shots as this up to around 200 yards with his .250. One incident that shows something of the confidence he had in the rifle was related to me some time ago and I will give it as near as I can recall it. This trapper was stationed near the Park. For years a big bear had been raising particular hell with hunters' camps. When anyone would get onto him he would make for the Park and was safe. He had been shot a number of times. This day my friend and his trapper got onto the old fellow. C., my friend, was armed with a .22 Savage H. P., and S. the trapper, had his .250. The day was stormy; in the half light of the mountain side the two men planned their attack. There before them lay the track of the mighty beast. One hunter was armed with his coyote rifle while the other wasn't armed with a very heavy weapon. As the bear was going parallel with the Park line they split, C. making toward the Park line so as to cut in ahead of the bear and turn him out of the Park, while S. took in after the monster. S. trailed along in a fine snow that was gently sifting through the branches of the spruces. After some time he saw ahead of him through the half gloom of the forest the huge bulk of the bear coming toward him. S. stopped, opened his rifle to make sure there was no snow in it, then standing at the ready he waited the coming of the bear that had foiled them all. S. let the bear come toward him till it was something like thirty feet away when he killed it dead with one shot in the head; to make sure he put in one more into the neck. The bear from what C. told me probably did not see S. at all and would have passed him had he not shot him when he did. The old fellow was back tracking for his day bed. One of the other guides in the Cody country has been using a .250 for some time; he has killed both elk and bear with it and was very well satisfied with it the last time I saw him. While at first, I myself, was a little afraid that the .250 was not large enough for big game, yet when we take into consideration the big game that is being killed with it, and especially the reports that we get from Charles Cotter from Africa, it cannot be denied that the little rifle has the power. With it as with any rifle it is the man behind the gun that counts; however where a man can have only one rifle, and where he may take a big game hunt once to a hundred shots at smaller fry, I really cannot see how the .250 can be bested very much. Of course don't misunderstand me, if a man can afford more than one rifle I think he should

have one carrying a heavier charge for such game as elk, bear and moose, but I can see no reason why a fellow should turn down a hunt, if he owns a .250, just because he has no heavier rifle. It should take a little better hunting and a little closer shot, but if the hunter is able to place his shots where they should be, it should be his fault and not the rifle's, should his hunt not be a success. The .250 cannot be compared with the .25-35, .30-30 or this class of rifles; it far outclasses them, and one will not realize this until using it or seeing it used on game. I have in mind three rifles that I hope to own some day, that is when scheckles are more plenty around these diggings; they are a Savage N.R.A. .22 R.F., a Savage .250–3000 bolt action, and last but not least a sporting model Springfield. Until such time though my little .250–3000 with its Lyman sights, lever action, home made sling will be high gun in my rack and on my hunts.

Now concerning a home-made sling: In *Arms and the Man* of a past issue some one asked about slings for sporting rifles, stating that the swivels they had would not take the army width strap. Now I have had a sling on my .250 model 99 Savage for a long time; the one that came on the rifle was the regular double swivel arrangement with hooks that fastened into eyes in stock and forearm. I never did like it for a number of reasons so I got busy and figured out a way and made me a regular Whelen-style sling with real sling swivels. First I discovered that the bow sling swivel from the old Springfield cal. 45 would fit the eyes on my rifle. Accordingly I sent to Bannermans for two bow sling swivels, complete with screws for the Springfield cal .45, also at the same time had them send me one of their 30 cent leather slings with double hook. These arrived and I immediately placed the swivels on my rifle, got out my copy of the *American Rifle* and with the help of a little whang leather made me a dandy sling from the old one, made on Lt. Col. Whelen's pattern. A little oil put the leather into good shape and so now I have what this other fellow asked for, a real sling, real sling swivels, and all for less than a dollar expense. One hasn't any idea of how a sling can help in shooting until trying it. In shooting at prairie dogs it is no great trouble to hit them in the head when using the sling, whereas, with the same rifle without it makes you go some. Anyone who believes that a .250 Savage isn't accurate better go slow about betting any money on his opinion; it certainly shoots closer than I for one can hold. Try out my sling idea friend and I believe you will like it.

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The Best from Contemporary Sources

THERE are a number of ways in which the power of the .22 miniature rifle may be increased. Taking for granted that the material of the barrel is able to withstand the strain, and that the breech mechanism is also of sufficient strength, a flatter trajectory may be attained by increasing the charge in the cartridge and so obtain a higher muzzle velocity, or by increasing the weight of the bullet and also increase the weight of the charge so that the muzzle velocity may remain as before. There are other combinations in the way of increasing the weight of the propellant and increasing the weight of the bullet.

Increasing Power of Rifles.

For the moment let us consider the question from the standpoint of raising the muzzle velocity. We will assume that the bullet remains as at present, that is of diameter .22 inches and weight about 40 grains, and that the propellant charge only is altered by an increase in weight. In such case the maximum pressure would be increased and so also would the muzzle velocity. The maximum pressure occurs quite close to the breech-block and any increase in it would have to be considered with this fact in mind. We will not, however, concern ourselves with this matter at the moment, but consider only what would be gained by an increase in the muzzle velocity.

The muzzle velocity of the long .22 cartridge in general use is about 1,100 ft. per second. The weight of the bullet, divided by the square of the diameter, is the measure of the ballistic efficiency of the bullet, a factor which is called the ballistic coefficient. So that, as the weight of the bullet is 40 grains or 0.00571-pound, and the square of the diameter is 0.0484 we have for the ballistic coefficient, which we will designate by C, the value:

$$C = \frac{0.00571}{0.0484} = 0.118.$$

We are assuming that the value of C remains the same and that only the muzzle velocity, V, alters, and we may look at what these conditions mean in the way of flattening the trajectory and altering the elements of the bullet's flight. Two increases in the muzzle velocity may be considered alongside the muzzle velocity of the existing cartridge, and these increases we will take as V = 1,500 ft. per second and V = 2,000 ft. per second.

Taking the elevation of the trajectory in the first instance we have the following figures:

Muzzle velocity (feet per sec.)	Elevation for Trajectory at Range. 10yds.	25yds.	100yds.
	minutes.	*minutes.*	*minutes.*
1,100	1½	3½	15½
1,500	1	2	9½
2,000	½	1	5

The elevations above are given in minutes of angle (riflemen's "degrees"). It is to be seen that, whereas the decrease in the elevation obtained by increasing the muzzle velocity from 1,100 ft. per second to 2,000 ft. per second is not very much at such a small range as 10 yards, it is very appreciable at the 100 yards range. Remembering that 1 inch on the target at a 100 yards is equivalent to a minute in elevation will help to give us some idea of the flattening in the trajectory that has been obtained, and the consequent small alteration in sighting necessary up to 100 yards range.

The manner in which the velocity is maintained in the trajectory is to be seen by looking at our next table which gives the remaining velocity at the end of each of the three ranges selected for our calculations:

Muzzle velocity (feet per sec.)	Remaining velocity at Range. 10yds.	25yds.	100yds.
	f.s.	*f.s.*	*f.s.*
1,100	1,077	1,051	938
1,500	1,444	1,375	1,110
2,000	1,930	1,830	1,410

It is to be seen that the rate of fall of velocity is greater in the case of the higher muzzle velocity cartridge. Remaining velocity only interests us from the point of view of its striking power. If the striking energy is increased the material of the butts has to be considered as the little miniature bullet can become most destructive in time. The striking energy which depends on the striking, or remaining, velocity, is considered in our next tabulation:

Muzzle velocity (feet per sec.)	Striking energy at Range. 10yds.	25yds.	100yds.
	ft.-lbs.	*ft.-lbs.*	*ft.-lbs.*
1,100	103	98	78
1,500	185	167	109
2,000	330	299	178

At the 10 yards range the V = 2,000 f.s. bullet is seen to be a powerful striking projectile, its energy being in the neighborhood of one-seventh of a foot-ton. At this range it is more than three times as powerful as a projectile as the bullet with the ordinary muzzle velocity of 1,100 ft. per second. Its power falls off rapidly, however, with range, as a glance at the figures tabulated shows.

The time of flight of the bullet is not of much concern to us but it may be given next:

Muzzle velocity (feet per sec.)	Time of Flight over Range. 10yds.	25yds.	100yds.
	secs.	*secs.*	*secs.*
1,100	0.030	0.069	0.30
1,500	0.022	0.053	0.24
2,000	0.016	0.039	0.18

The V = 1,100 f.s. bullet thus reaches the 10 yards target in less than one-thirtieth of a second and the V 2,000 f.s. bullet takes only about half this time. Travelling at V = 2,000 f.s. the miniature bullet would take less than a fifth of a second to cover a range of 100 yards.

Flatness of trajectory is a matter of more moment to us and this may be set out in the final table:

Muzzle velocity (feet per sec.)	Maximum Height of Trajectory over Range. 10yds.	25yds.	100yds.
	inch.	*inch.*	*inch.*
1,100	0.04	0.23	4.3
1,500	0.02	0.13	2.8
2,000	0.01	0.07	1.6

This table gives us some idea of the wonderful flatness of even the existing .22 bullet which rises from the true "point-blank" line only 4.3 inches over 100 yards of range. The remarkable reduction in the case of the V 2,000 f.s. bullet for the same range is to be noticed, the bullet rising but a fraction over 1½ inches from the line of sight.

We have seen what might be done in the way of increasing the power of the .22 bore by giving extra velocity to the bullet. Now we propose to look into the effect caused by increasing the ballistic coefficient, the factor which determines the power the bullet has of forcing its way through the air.

It is just as well to impress upon our minds that the two prime factors of the trajectory are the velocity and the ballistic coefficient. The more we increase these the greater is the power of the projectile, so that, theroretically speaking, there is nothing to prevent the attaining of any range in a weapon. As this is being written there is talk of a gun, said to be in course of construction in France, the invention of M. Delamare-Maze, which will have a range of 150 miles. Theoretically there is nothing to prevent the construction of such a powerful weapon in so far as exterior ballistics are concerned. The great difficulties to be experienced are in the actual construction of the gun, in order that a projectile of the required combination of weight and diameter (as measured by the ballistic coefficient) may be projected with sufficient muzzle velocity in order to attain the great range desired. It is then a question of the construction and strength of the weapon more than anything else.

Now as we have seen the little .22 bullet, weighing 40 grains, could have its trajectory very materially improved if the veloctiy were increased. We considered two increases of muzzle velocity, viz., 1,500 feet per second and 2,000 feet per second as against the 1,100 feet per second which is somewhere about the figure obtaining with existing .22 long ammunition. When we come to consider the figures to be given later concerning the effect of increasing the ballistic coefficient we shall see that in the case of miniature ammunition such increase does not have much effect. In other words, much more may be done by increasing the charge so as to get greater muzzle velocity than by increasing the ballistic coefficient.

As we said the ballistic coefficient of a bullet is the factor obtained by dividing the weight of the bullet in pounds by the square of the diameter in inches. So that to increase this factor we must either increase the weight of the bullet or decrease its diameter. Decreasing the diameter is at once put out of court, unless we wish to make the already small calibre of the miniature rifle smaller still, so that we must consider the effect of a change in ballistic coefficient as occasioned by making the weight of the bullet greater. Suppose we consider a weight of 48 grains as compared with the regulation 40 grains and see what happens. We get for the ballistic coefficient, C, the value:

$$C = \frac{0.00686}{0.0484} = 0.142,$$

as 40 grains is equal to 0.00686 lbs. and the square of the diameter is 0.0484. Our new C, compared with the regulation value of 0.118, used in previous calculations, has thus been exceeded by 20 per cent.

It we increase the weight of the projectile, and the charge of powder in the cartridge remains unaltered, there would, of course, be a diminution in muzzle velocity. What this diminution would amount to would be rather difficult to estimate; it is essentially a question for experiment to determine if reliable figures are required. We shall, in what follows, assume that a few extra grains of powder are added to the cartridge so that the muzzle velocity of 1,100 feet per second of the existing cartridge is maintained, and also consider alongside the effect of a 48-grain bullet travelling with a muzzle velocity of 1,500 feet per second.

Considering the elevation first we have the following figures for a 48-grain bullet:

Muzzle velocity (feet per sec.)	Elevation for Trajectory at Range. 10yds.	25yds.	100yds.
	mins.	*mins.*	*mins.*
1,100	1½	3½	15¼
1,500	1	2	9

Comparing these figures with the figures given for elevation with the existing weight of bullet already given, we see that for the same velocities there is very little decrease in elevation caused by a 20 per cent increase

in weight. At the most, the improvement is no more than a quarter of a minute of angle, even with the higher velocity of 1,500 feet per second.

Remaining velocity is maintained in a slightly improved degree, as witness:

Muzzle velocity (feet per sec.)	Remaining Velocity at Range. 10yds.	25yds.	100yds.
	f.s.	*f.s.*	*f.s.*
1,100	1,082	1,058	961
1,500	1,456	1,395	1,153

The 48-grain bullet has therefore a remaining velocity 23 feet per second greater at a range of 100 yards with a muzzle velocity of 1,100 feet per second and 43 feet per second greater with a muzzle velocity of 1,500 feet per second than the ordinary bullet of 40 grains weight.

Increase of remaining, or striking, velocity implies greater striking energy, there being an increase of 33 foot pounds with the 48-grain bullet over the 40-grain bullet at a range of 100 yards with the 1,500 feet per second muzzle velocity:

Muzzle velocity (feet per sec.)	Striking Energy at Range. 10yds.	25yds.	100yds.
	ft-lb.	*ft.-lb.*	*ft.-lb.*
1,100	125	119	98
1,500	226	207	142

Figures for time of flight may be given in order to make complete the whole of our data; but the figures are very little different with the 48-grain bullet than with the bullet of ordinary weight:

Muzzle velocity (feet per sec.)	Time of Flight over Range. 10yds.	25yds.	100yds.
	secs.	*secs.*	*secs.*
1,100	0.028	0.070	0.29
1.500	0.021	0.052	0.23

The height of the maximum ordinate, by which we measure the "flatness" of the trajectory, shows a slight improvement with the 48-grain bullet amounting to about a quarter of an inch at 100 yards with 1,500 feet per second muzzle velocity:

Muzzle velocity (feet per sec.)	Maximum Height of Trajectory over Range. 10yds.	25yds.	100yds.
	inch.	*inch.*	*inch.*
1,100	0.04	0.23	4.1
1,500	0.02	0.13	2.5

It is evident, therefore, from a consideration of the figures given in this article, in which an increase in the ballistic coefficient has been studied, in comparison with the figures given for an increase of muzzle velocity, that much more is to be gained by increasing the speed of the bullet than by increasing its weight.

Balistica, in *The Rifleman*.

Rifle Trajectory At High Elevations.

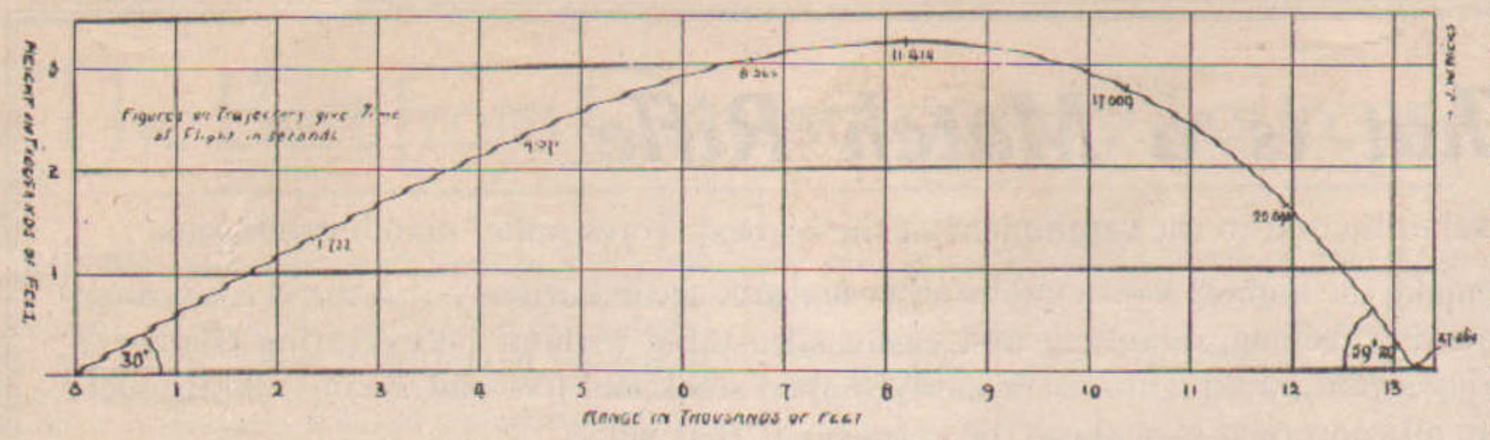
AS one of the results of the late war the importance of high angle shooting in the gunnery of the future has now received its full meed of recognition. Not only does the problem of anti-aricraft gunnery need a full and accurate determination of the trajectory's path, but the application of "indirect" fire in attack at the maximum range of guns makes it vitally necessary that a more rigid determination of the ballistic elements shall be the procedure henceforth.

The new conditions of practical ballistics will increase the work of the calculator tenfold. In the days before the war the ballistic tables contained many labour-saving functions which served to give an accurate answer to the majority of gunnery problems. Those were the days of high velocity guns of small elevation, and of the howitzer-type of ordnance with small velocity and high elevations attaining to comparatively low atmospheric altitudes. The ballistic problem now demands also a solution in the case of high velocity guns with high elevation, and this entails an analytical integration of the trajectory which adds greatly to the labour of

30° Trajectory of .303 Mark VII Bullet
M. V. 2440 f. s.

Table I.

Arc of trajectory.	Range covered in arc.	Range covered to end of arc.	Height ascended (+) or descended (—) in arc.	Height of trajectory at end of arc.
	Feet.	*Feet.*	*Feet.*	*Feet.*
30° to 29°50′	452.9	452.9	260.6	260.6
29°50′ to 29°40′	335.3	788.2	191.6	452.2
29°40′ to 29°30′	265.2	1053.4	150.5	602.7
29°30′ to 29°20′	219.1	1272.5	123.6	726.3
29°20′ to 29°10′	186.6	1459.1	104.5	830.8
29°10′ to 29° 0′	162.9	1622.0	90.6	921.4
29° 0′ to 28°30′	398.5	2020.5	218.6	1140.0
28°30′ to 28° 0′	323.3	2343.8	173.7	1313.7
28° 0′ to 27°30′	281.7	2625.5	148.2	1461.9
27°30′ to 27° 0′	254.2	2879.7	130.9	1592.8
27° 0′ to 26°30′	233.1	3112.8	117.5	1710.3
26°30′ to 26° 0′	216.1	3328.9	106.6	1816.9
26° to 25°	391.2	3720.1	186.6	2003.5



30° Trajectory of ·303 Mark VII Bullet. M.V.=2440 f.s. C=0·382.

25° to	24°	348.7	4068.8	158.9	2162.4
24° to	23°	315.7	4384.5	137.3	2799.7
23° to	22°	288.7	4673.2	119.6	2419.3
22° to	21°	265.8	4939.0	104.7	2524.0
21° to	20°	246.4	5185.4	92.1	2616.1
20° to	18°	444.9	5630.3	153.2	2769.3
18° to	16°	393.7	6024.0	120.4	2889.7
16° to	14°	353.6	6377.6	94.8	2984.5
14° to	12°	321.4	6699.0	74.2	3058.7
12° to	10°	295.2	6994.2	57.4	3116.1
10° to	8°	273.4	7267.6	43.3	3159.4
8° to	6°	255.1	7522.7	31.3	3190.7
6° to	3°	354.9	7877.6	27.9	3218.6
3° to	0°	327.0	8204.6	8.6	3227.2
0° to	— 3°	304.7	8509.3	— 8.0	3219.2
— 3° to	— 6°	286.9	8796.2	— 22.6	3196.6
— 6° to	— 9°	272.3	9068.5	— 35.9	3160.7
— 9° to	—12°	260.7	9329.2	— 48.3	3112.4
—12° to	—15°	251.4	9580.6	— 60.3	3052.1
—15° to	—20°	403.6	9984.2	—127.2	2924.9
—20° to	—25°	391.1	10375.3	—162.0	2762.9
—25° to	—30°	385.1	10760.4	—200.5	2562.4
—30° to	—35°	385.1	11145.5	—245.4	2317.0
—35° to	—40°	390.5	11536.0	—299.7	2017.3
—40° to	—45°	401.1	11937.1	—367.6	1649.7
—45° to	—50°	417.2	12354.3	—455.3	1194.4
—50° to	—55°	439.0	12793.3	—572.1	623.2
—55° to	—59°20′	402.1	13195.4	—623.2	0.0

the ballistic calculator. Sometime hence we may expect to return in some degree to the state before the war, a time when other "auxiliary" or "secondary" functions will be produced as a result of a great deal of "small arc" calculation duly tabulated and made easy for reference and interpolation. Even so the numerical work will still be very much more than before. The Americans, who were the first to realize fully the important labour-saving value of "secondary" functions, as witness Colonel Ingalls' voluminous ballistic tables, have already in course of production new tables which conform more or less to the new conditions, but until these are published it is useless to give an estimate of their quality. Lieut. Colonel R. K. Hezlet, C.B.E.,R.A., has hinted in a recent contribution to the *Journal of the Royal Artillery* that new experiments on the resistance of the air are contemplated in England, and until such experiments are carried out we cannot safely claim to be meeting the new conditions by adequately correct ballistic tables.

The rifle is concerned in the revolution in ballistic practice now proceeding, for it will also be included in problems generally classified as "indirect" fire. The small arm introduces a difficulty of its own. Up to 15° or 20° an answer could be obtained for most ordnance by using the "secondary" ballistic functions, but not so with the rifle. For elevations exceeding 9° or 10°, say, the "secondary" functions, such as the double-entry "A" table of the ballistic tables published with the *Text Book of Small Arms*, 1909, were not extensive enough to provide the data for a solution. In the tables quoted the value of R/C (that is, range in yards divided by the ballistic coefficient) is tabulated against muzzle velocity, and for the elevations named the entries are not sufficiently extensive. When rifle problems are attacked for a moderately high elevation, there is at present but one method of solution, and that is the laborious one of "small-arcs," or piecemeal integration.

In previous issues of *Arms and Explosives* (January and March, 1914) the present writer has shown how the calculation of the small-arm trajectory at such high elevations as 30° and 60° can be performed. The object which was then in mind was to show particularly the value of the "cosine" rule as an expeditious means of obtaining an answer to the problem of attack by rifle fire *in the air*. The calculations then published were not carried to the ground; in fact, using the English ballistic tables, such as those published with the *Text Book of Small Arms*, or *Tables for use with the Text Book of Gunnery*, a complete solution of the trajectory would not be possible. "Small arc" calculations necessitate the use of the primary S, A, I and T functions, and of these the important A and I functions are not tabulated below 500 f.s. The greater portion of the descending arc of a rifle trajectory at most elevations is in the region of velocities below 500 f.s., so that a solution by the published ballistic tables of this country is not possible, at any rate by using the primary functions.

The main object of the present contribution is to show how the trajectory at high elevations with the rifle may be performed, and to indicate in some manner the difficulties of a correct solution. The summary of the calculations given may be considered in the light of spade-work done in order to estimate what are the proper coefficients to introduce in order that something like a correct answer may be obtained.

The difficulty with the English ballistic tables being accepted the only recourse is to use Ingalls' Tables. These tables have one great advantage, in that below 825 f.s. the compiler has calculated his functions using $n = 2$. The quadratic law for velocities below about 800 f.s. is generally recognized to be preferable to using any other value such as the $n = 1.6$ of our own ballistic tables.

According to *Musketry Regulations*, Part I, 1912, the maximum range with the Service rifle and Mark VII. ammunition is about 3,500 yards. This figure is indefinite, being apparently deduced from a firing with Mark VI. ammunition carried out when a strong rear wind was operating. The elevation is not mentioned, but it is known that the maximum range is obtained at an angle of elevation a little greater than 30°. For the present calculations we will use an elevation of 30°.

The value of $K\sigma$ to be used is one of the principal causes of trouble, and of the vitiation of results. The analysis of the *Musketry Regulations* Range Table for the Service rifle and Mark VII. ammunition gives a value of $K\sigma = 0.61$ at 1,000 yards, 0.70 at 1,500 yards, and 0.78 at 2,000 yards. This indicates that the projectile either becomes unsteady as the range increases, or that the effect of "yaw" is increasing. It also indicates that, if an average value of $K\sigma$ were to be used for a high angle trajectory and that if this average value were to be anything near the truth it should be a very large value indeed. What the correct mean value should be is at present simply a matter of valueless guesswork. The fact is that the high angle trajectory, in order to be of numerical accuracy, must be calculated in "small-arcs" giving to each small arc its proper value of $K\sigma$ (this factor to include a coefficient for "yaw"). In the present "spade-work" an attempt is not made to give appropriate small-arc values for $K\sigma$, but as a first trial it serves a useful purpose to perform the calculation assuming the ideal condition of complete stability of the bullet and the entire absence of "yaw."

Table II.

Arc of trajectory.	Time taken to traverse Arc.	Complete time taken to end of arc.	Remaining velocity at end of arc.	Altitude factor (f) used in arc.
	secs.	*secs.*	*f.s.*	
30° to 29°50′	0.233	0.233	2058.4	1.004
29°50′ to 29°40′	0.201	0.434	1806.2	1.011
29°40′ to 29°30′	0.177	0.611	1626.0	1.016
29°30′ to 29°20′	0.162	0.773	1491.2	1.020
29°20′ to 29°10′	0.149	0.922	1385.4	1.023
29°10′ to 29° 0′	0.139	1.061	1301.2	1.026
29° 0′ to 28°30′	0.375	1.436	1138.9	1.031
28°30′ to 28° 0′	0.336	1.772	1050.0	1.037
28° 0′ to 27°40′	0.312	2.084	990.4	1.042
27°30′ to 27° 0′	0.295	2.379	945.9	1.046
27° 0′ to 26°30′	0.282	2.661	908.6	1.050
26°30′ to 26° 0′	0.270	2.931	876.5	1.053
26° to 25°	0.510	3.441	823.4	1.057
25° to 24°	0.478	3.919	781.0	1.063
24° to 23°	0.452	4.371	745.1	1.067
23° to 22°	0.429	4.800	713.9	1.071
22° to 21°	0.408	5.208	686.3	1.074
21° to 20°	0.390	5.598	661.7	1.077
20° to 18°	0.735	6.333	619.9	1.081
18° to 16°	0.683	7.016	585.5	1.085
16° to 14°	0.641	7.657	556.7	1.088
14° to 12°	0.606	8.263	532.2	1.091
12° to 10°	0.577	8.840	511.2	1.093
10° to 8°	0.551	9.391	492.9	1.094
8° to 6°	0.530	9.921	477.0	1.095
6° to 3°	0.763	10.684	456.8	1.096
3° to 0°	0.730	11.414	439.9	1.097
0° to — 3°	0.705	12.119	425.8	1.097
— 3° to — 6°	0.685	12.804	414.0	1.096
— 6° to — 9°	0.671	13.475	404.2	1.095
— 9° to —12°	0.663	14.138	396.3	1.094
—12° to —15°	0.658	14.796	389.8	1.092
—15° to —20°	1.098	15.894	382.1	1.090
—20° to —25°	1.115	17.009	377.8	1.086
—25° to —30°	1.153	18.162	376.4	1.080
—30° to —35°	1.212	19.374	377.8	1.073
—35° to —40°	1.299	20.673	381.7	1.065
—40° to —45°	1.417	22.090	388.1	1.055
—45° to —50°	1.577	23.667	397.1	1.043
—50° to —55°	1.796	25.463	408.4	1.027
—55° to —59°20′	1.797	27.260	419.7	1.009

Supposing an average value of $K\sigma$ for an ideally steady bullet, travelling with its axis tangential to the trajectory, the value would be, using the English ballistic tables, 0.67. The equivalent value using Ingalls' Tables is 0.68, or a C of 0.382, and this value it is which has been used in the calculation the summary of which is given in Tables I. and II. of this article. The method of calculating will now be explained step by step, the whole calculation summarized in Tables I. and II. involving,

(*Continued on page 17*)

SHOOTING NEWS AND COMMENT

CAPTAIN E. C. Crossman, Experimental Officer at the Daytonia, Florida, Small Arms Ballistic Station, recommends a highly novel method of getting a bullet through a rifle barrel, and incidentally discusses the boat-tailed bullet question in a recent letter. The Captain's contribution to the boat-tail question follows:

"Daytona, Fla., April 20, 1920.

Editor Arms and The Man:

I have noticed in your estimable magazine various strategic devices for getting a boat-tail bullet "through the barrel." It seems to me that the gentlemen describing the process went to much trouble in view of the fact that the Swiss riflemen visiting our country in 1913 shot boat-tail bullets and defeated the American team in the free rifle match.

I am sending to you therefore, two original groups I shot in the routine work of this station with the M 1919 U. S. boat-tail bullet at 200 yards, using the Mann rest. We got the bullet "through the barrel" by the novel method of putting a load of powder behind it, and touching said load off with a primer.

The groups are ample evidence that after getting through, the bullet continued on the even tenor of its way, with the minor deviating influences of gravity and air resistance.

Likewise while time forbids going into the matter in detail, permit me to advise various theorizing ballisticians appearing in your columns in re the boat-tail bullet that they are barking up the wrong tree, and that the coon is not even in the same patch of woods with them. The weakness of the theorists in this country as in England is that they figure too much and shoot too little. The true performance of the boat-tail bullet is amazing—and does not agree with theory.

SPORTSMEN concerned in exterminating predatory vermin that prey on small game will be interested in a unique method of driving earth burrowing vermin from their dens, suggested by D. H. Selden, of Richmond, Va. Mr. Selden has long been breeding quail in captivity and like all game-breeders has suffered much from the depredations of vermin. One of the most essential co-workers in Mr. Selden's experiments has been the common land tortoise. In a large tub or barrel with a foot of earth in the bottom the tortoises are kept until needed.

When a raid on vermin is planned, they are taken in a sack and the hillsides thereabout are searched for holes that would possibly be inhabited by vermin. While not essential, a dog is of great aid in ascertaining whether or not the burrow is inhabited.

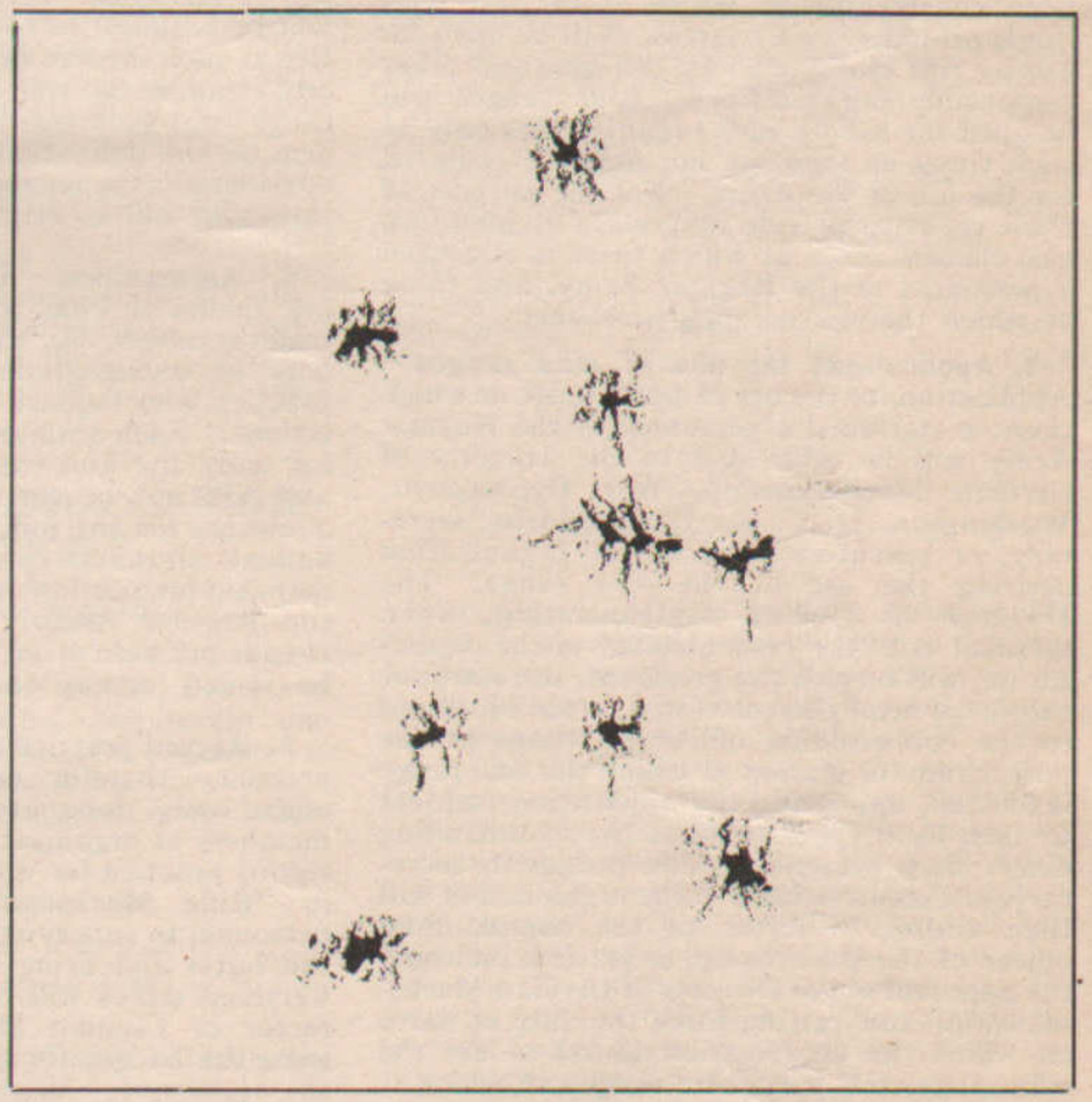
First, a small hole is made in the shell of the tortoise just back of the tail. Into this a light piece of wire from four to six inches long is tied. On the other end of the wire is hooked a strip of felt an inch to an inch and a half in width and eight to ten inches long. The felt is then lighted and the tortoise started into the hole. As the felt burns slowly with much smoke, there is no question but that anything inhabiting this hole will soon seek fresh air and shortly afterward will be followed by the tortoise, who when he reaches the end of the hole, will nearly always turn and come back out again, unless by some chance he loses his smudge and burrows deeper into the earth.

Mr. Selden said he has used this system for years and that it always works except in cases where water is in the burrow which, of course, extinguishes the fire.

An old felt hat makes admirable material for the wicks. Every one knows that it is almost impossible to smoke vermin out of their burrows, but the land tortoise carries the smoke down to them. If they block up the passage, he quickly burrows through the obstruction and continues until he explores every nook and corner. We have been assured that very shortly after he enters things are apt to happen at the mouth of the hole. A sack with a hoop sewed into the mouth is very handy in capturing the vermin as they leave their burrows. Mr. Selden suggests that any one using this method wear heavy buckskin gloves, as they are very apt to be bitten and scratched unless their hands are well protected. Again the dog comes in handy besides locating the game. He is often much in demand, especially when from thre to five animals bolt almost simultaneously from the same hole in the ground. Personally, we would much rather have some one else hold the sack, provided a family of skunks were occupying the hole into which we directed our friend, the land tortoise.

It is also suggested that you first consult the game laws before using Mr. Selden's method, as in some states such a procedure is illegal.

USE of government rifle ranges for rifle practice by citizens of the United States has been made the subject of a special bulletin by the General Staff, U. S. A. Under these regulations it is possible for civilian rifle clubs to obtain the use of government ranges under certain conditions. The full text of the regulation is:



The group shot with the M. 1919 Boat-tail. This is practically the bullet the Swiss will use in the Olymyic Games.

Use of Rifle Ranges for Rifle Practice by Citizens of the United States.

1. Act of Congress.—The act of Congress approved June 3, 1916, authorizes the use of

rifle ranges, arms, ammunition, and target materials for rifle practice by citizens of the United States, in section 113, which reads as follows:

Sec. 113. *Encouragement of rifle practice.*—The Secretary of War shall annually submit to Congress recommendations and estimates for the establishment and maintenance of indoor and outdoor rifle ranges, under such a comprehensive plan as will ultimately result in providing adequate facilities for rifle practice in all sections of the country. And that all ranges so established and all ranges which may have already been constructed, in whole or in part, with funds provided by Congress shall be open for use by those in any branch of the military or naval service of the United States and by all able-bodied males capable of bearing arms, under reasonable regulations to be prescribed by the controlling authorities and approved by the Secretary of War. That the President may detail capable officers and non-commissioned officers of the Regular Army and National Guard to duty at such ranges as instructors for the purpose of training the citizenry in the use of the military arm. Where rifle ranges shall have been so established and instructors assigned to duty thereat, the Secretary of War shall be authorized to provide for the issue of a reasonable number of standard military rifles and such quantities of ammunition as may be available for use in conducting such rifle practice.

2. General provisions.—All rifle ranges at posts, camps, and stations of the United States Army, and all rifle ranges which have been constructed in whole or in part with funds provided by Congress, shall be open for use by rifle clubs, schools, colleges, and other responsible organizations. Rifle ranges will be open for use by such organizations only at such times as they are not actually required for the use of the Army. For the purpose of these regulations, rifle ranges are divided into two classes: those at which there is stationed a personnel of the Regular Army, and those at which there is no such personnel.

3. Applications for use of rifle ranges—Application for the use of a rifle range at which there is stationed a personnel of the Regular Army will be addressed to the Director of Civilian Marksmanship, War Department, Washington, D. C., by the president, secretary, or executive head of the organization desiring the use of the rifle range. The Director of Civilian Marksmanship, when satisfied as to the responsibility of the organization, will furnish the president, secretary, or executive head thereot with a letter addressed to the commanding officer of troops at the post, camp, or station at which the rifle range is located, approving the application, subject to such local regulations as the commanding officer may prescribe. The president, secretary, or executive head of the organization will then address a letter to the commanding officer of the post, camp, or station, inclosing the approval of the Director of Civilian Marksmanship, and setting forth the date or dates on which the organization desires to use the rifle range, the particular ranges at which it is desired to fire, what kind of targets are desired at each range, whether instructors are desired, and whether or not the organization will furnish its own arms and ammunition. The commanding officer will reply, stating whether or not the rifle range will be available on the dates requested, or it not, the dates on which it will be available; which, if any, of the facilities requested can be furnished; and to whom the organization should report on arrival at the rifle range. Subsequent applications for the use of the rifle range by the same organization may be conducted in a less formal manner as agreed to by the range authorities and the organization.

4. Personnel and target materials.—Commanding officers at all posts, camps, and stations provided with rifle ranges will detail an officer in charge of civilian rifle practice, with such assistants as may be necessary. The officer in charge will be responsible for the proper use and preservation of all Government property involved, that the local regulations are observed, and that the proper precautions for safety are observed by all civilians using the rifle range. When the personnel of the Regular Army present will permit of such assistance, the commanding officer, on request, will detail instructors in marksmanship. Details for marking the targets will not be furnished. Organizations will make necessary arrangements for the manual labor incident to the operation of the rifle range. The necessary and regular target material will be provided unless the organization elects to provide its own target material. Special target material, such as special targets, field glasses, telescopes, score books, etc., must be provided by the organization. Organizations may desire to use arms, ammunition, methods of firing, and target arrangement at variance with those prescribed for the Regular Army. To this there is no objection, provided the precautions for safety are observed and no expense to the United States is involved.

5. Issue and care of arms.—Commanding officers, when necessary, will make requisition for United States rifles, calibre .30, model of 1903, and appurtenances for civilian target practice on the basis of four rifles for each target available on the range, but not to exceed 50 rifles for any one post, camp, or station. Such rifles will be issued daily to members of organizations who apply for the use of the same. Civilians using these rifles will be required to complete their daily practice at such time as will permit of their properly cleaning the rifle before leaving the rifle range, and such care and preservation of the arm by the individual using the same will be considered as a necessary part of his instruction, and will be required.

6. Ammunition.—Ball cartridges, calibre .30, model of 1906. and gallery practice cartridges, calibre .30, will be issued to all members of organizations participating in rifle practice who request them under these regulations. Such ammunition will be issued only for daily use and expenditure on the range, and will not be carried away. The annual allowance for any individual will not exceed the annual allowance prescribed for the marks manship instruction of the Infantry soldier of the Regular Army, nor will more than 50 rounds per man of either kind of ammunition be issued for any one day's practice.

7. Record practice for qualification.—When necessity therefor arises, the commanding officer may designate a day or days when members of organizations may participate in record practice for qualification as prescribed in "Rifle Marksmanship." The necessary personnel to supervise and record the firing at the butts and firing point will be provided. Certified scores will be forwarded to the Director or Civilian Marksmanship, who will issue the badges for qualification.

8. Denial of privileges in certain cases.—Commanding officers will deny the privilege of the range and post to any civilian who willfully disobeys any of the rules and regulations prescribed for the use of the rifle range, or whose conduct on the rifle range or post is such as to warrant such action. Commanding officers are also authorized to refuse the use of the rifle range to any individual whose knowledge of the basic principles of rifle shooting is so lacking that range practice will be of no value to him, or unsafe to himself or others; but in such cases will offer the individual the services of an instructor in basic principles necessary as a preparation for range firing.

9. Additional rules to be prescribed. Commanding officers are authorized to prescribe such additional and necessary rules and regulations as may be necessary, keeping in mind that it is the intention of Congress that, so far as is consistent with the proper training of troops, the range facilities and personnel of the Army shall be available for the instruction in rifle practice of all able-bodied male citizens capable of bearing arms. Whether or not rifle ranges shall be open for practice by civilian organizations on Sundays and holidays is left to the commanding officer.

10. Records and reports.—A record will be kept of the number civilians using the rifle range, and the number of rounds of ammunition expended under these regulations. An annual summary from this record will be forwarded by commanding officers on December 31 of each year directly to the Director of Civilian Marksmanship, War Department, Washington, D. C.

11. Use of ranges where no Regular Army personnel is present—Organizations who desire to use rifle ranges located at posts, camps, stations, or other places at which there is no personnel of the Regular Army present will make application for the necessary authority to the Director of Civilian Marksmanship. The Director of Civilian Marksmanship will make the necesary arrangement with the Adjutant General of the Army, or other authorities, and will communicate to the applicant the rules and details under which the said range may be used. Organizations using such ranges must provide their own arms, ammunition, and target materials, or arms, ammunition, and target materials obtained through the Director of Civilian Marksmanship, as provided by law.

THESE ninety per cent awards have been made among the members of college, military school and high school teams competing in the 1920 N.R.A. Gallery competitions:

90% Medals, Colleges, 1920.

Day, R. K., Syracuse Univ.	198.4
Martin, P. M., Norwich Univ.	198.4
Gibson, A. L., Syracuse Univ.	197.5
Shaw, R. K., Norwich Univ.	197.5
Bensan, E. I., Univ. of Pennsylvania	197.4
Byrne, J. R., Univ. of Pennsylvania	197.2
Harrington, A V., Norwich Univ.	196.9
Inghram, J. F., Dartmouth College	196.7
Ten Broeck, P. D., Univ. of Pennsylvania	196.6
Steele, D. M., Univ. of Pennsylvania	196.5
Brines, W. P., Univ. of Pennsylvania	196.
Woodworth, R. W., Syracuse Univ.	195.6
Dodkin, O. H., Worcester Polytech. Inst.	195.7
Anderson, D. V., Norwich Univ.	195.4
Robertson, R. H., Univ. of Pennsylvania	195.4
Marquette, Penrose, Univ. of Pennsylvania	195.2
Schmidt, A. J., Syracuse Univ.	195.2
Johnson, P. M., Mass. Inst. of Technology	195.
Cushman, R. W., Worcester Polytech. Inst.	194.4
Schweitzer, W. P., Columbia Univ.	194.4
Tillson, R. D., Mass. Agri. College	194.3
Condon, L. R., Columbia Univ.	194.1
Dean, G. E., Mass. Inst. of Technology	194.1
Perkins, J. R., Mass. Inst. of Technology	194.
Whitmon, V. E., Mass. Inst. of Technology	194.
Jones, E. H., Univ. of Pennsylvania	193.9
Spelman, H. R., Syracuse Univ.	193.9
Zwart, G., Norwich Univ.	193.9
Kearful, G. G., Mass. Inst. of Technology	193.5
Morell, F. B., Columbia Univ.	193.3
Reed, H. W., Dartmouth College	193.3
Hurlin, M. W., Bowdoin College	193.2
Kerr, Ralph, Columbia Univ.	193.2
Robinson, P. L., Mass. Agricultural College	193.1

Marston, J. L., Worcester Polytech. Inst.	192.7
Alland, A. B., Mass. Inst. of Tech. Freshman	192.4
Thayer, E. L., Worcester Polytech. Inst.	191.7
Sanderson, R. H., Mass. Agricultural College	191.6
Ellsworth, W. A., Worcester Polytech. Inst.	191.5
Fivaz, A. E., Syracuse Univ.	191.3
Hawkes, J. B., Columbia Univ.	191.2
Chapman, R. E., Worcester Polytech. Inst.	190.6
Page, H., Princeton Univ.	190.6
Lamber, R. B., Mass. Agricultural College	190.5
Guppy, J. W., Dartmouth College	190.4
Twiss, J. R., Columbia Univ.	190.3
Krenninger, J. F., Columbia Univ.	190.2
Hawes, M. C., Mass. Inst. of Tech. Freshman	190.1
Sanford, R. H., Mass. Agricultural College	189.8
Low, P. R., Bowdoin College	189.6
Benna, W. E., Princeton College	189.4
Helmer, B., Dartmouth College	189.4
Wells, R. R., Dartmouth College	189.4
Main, Stuart, Mass. Agricultural College	189.
Benton, A. M., Bowdoin College	188.9
Wells, W. G., Princeton College	188.8
Webster, M. F., Mass. Agricultural College	188.7
Potter, W. F., Mass. Inst. of Tech. Freshman	187.3
Barrans, W. J., Iowa State College	186.5
Holmes, J. A., Lehigh Univ.	185.5
Speir, R. W., Princeton	185.2
Cook, F. B., Mass. Agricultural College	185.2
Merriman, L. T., Univ. of Maine	184.9
Ruppel, W. H., Iowa State College	184.7
Hall, S., Mass. Inst. of Tech. Freshman	184.2
Hone, J. W., Bowdoin College	183.9
McAlpin, R. H., Iowa State College	183.5
Richardson, H. M., Princeton Univ.	183.5
Steineke, Max, Leland Stanford Univ.	183.4
Vaughan, S. E., Leland Stanford Univ.	182.3
Granger, G. B., Bowdoin College	181.2
Ardell, R. Jr., Leland Stanford Univ.	181.1
Simonds, W. W., Cornell College	180.6
Leighton, R. S., Univ. of Maine	180.1

MILITARY SCHOOLS

Campbell, G. T., St. John's M. A.	199.4
Christ, John, St. John's M. A.	199.1
Lorimer, A. H., St. John's M. A.	199.1
Ibberson, T. E., St. John's M. A.	198.7
Greene, Geo., St. John's M. A.	198.6
Colcord, G. R., Culver, M. A.,	196.4
Wolfe, R. E., Culver M. A.	195.5
Purinton, A. V., St. John's M. A.	195.
Whittlesey, M. W., St. John's M. A.	194.2
Gamble, A. S., St. John's M. A.	192.2
Hincke, J. I., Western M. A.	191.9
Reed, R. B., Western M. A.	190.5
Greene, H. E., New York M. A.	190.2
Johnston, M., Castle Heights M. A.	189.1
Mathews, C. X., New York M. A.	189.
Kent, L. S., New York M. A.	188.1
MacKillican, K. D., St. John's M. A.	187.6
Roberts, S., Western M. A.	187.6
Wagner, A. L., New York M. A.	187.6
Veit, Walter, Bordentown M. A.	186.7
Akridge, R. H., New York M. A.	186.3
Lincoln, J. D., Tenn. M. I.	185.3
Eichelberger, D. M., Bordentown M. A.	185.2
Gillmore, W. N., New York M. A.	185.2
Chick, Hoyt, Castle Heights M. A.	185.1
Ellis, J. B., Bordentown M. A.	184.5
Keon, Thos. H., Bordentown M. A.	184.5
Orr, W. J., Jr., Northeastern M. & N. Acad., 1st Team	184.3
Mayer, R. H., Northwestern M. & N. Acad., 1st Team	183.5
McCluer, J. C., Western M. A.	183.3
Littledale, K. G., Western M. A.	182.8
Metzger, K., New York M. A.	182.5
McGough, S. M., Northwestern M. & N. Acad., 1st Team	182.4
McDowell, A., New York M. A.	182.3
Baker, W. W., Northwestern M. & N. Acad., 1st Team	181.6
Hobson, H. P., Tenn. M. I.	181.6
Ferrell, A. A., Tenn. M. I.	180.9
Sawyer, G. D., Northwestern M. & N. Acad., 1st Team	180.7
Harlow, J. H., Northwestern M. & N. Acad., 2nd Team	180.3
Hunt, R., Tenn. M. I.	180.1
Glasscock, W. B., Castle Heights M. A.	180.
Martin, G. E., Northwestern M. & N. Acad., 1st Team	180.

HIGH SCHOOLS

Stow, M. H., Central H. S.	198.2
Greeley, J. R., Central H. S.	198.1
Hudspeth, C., Central H. S.	198.1
Middleton, S., Business H. S.,	197.8
Veitch, A. H., Central H. S.	197.8
Everett, H., Jr., Central H. S.	197.6
Artois, F. W., Central H. S.	197.5
Elliot, A. H., Central H. S.	197.2
Gray, Kimball, Jamaica H. S.	197.2
Barry, J. M., McKinley Manual Tr. H. S.	197.
Blanton, J. M., Central H. S.	196.9
Hands, E. R., Business H. S.	196.7
Anadale, Geo. A., Business H. S.	196.6
Rider, T. H., Central H. S.	196.6
Trimble, G. R., Business H. S.	196.6
McNish, A. G., McKinley Manual Tr. H. S.	196.4
Burrows, Wm. J., Business H. S.	196.3
Rosenberg, H. S., Business H. S.	196.1
Bates, L. D., Jamaica H. S.	195.4
Roberts, J. P., Western H. S.	195.3
Wrenn, Jos., McKinley Manual Tr. H.S.	194.7
Eldert, Jack, Jamaica H. S.,	193.9
Nettleship, Wm., Commercial H. S.	193.2
Sincell, C., Business H. S.	192.9
Cherry, W., Business H. S.	192.5
Woodward, R. H., McKinley Manual Tr. H. S.	192.5
Gamet, M. B., Evanston Township H. S.	191.2
Vosburgh, G., Jamaica H. S.	191.6
Speer, A., McKinley Manual Tr. H. S.	191.4
Meigs, P., 3rd. Ridgewood H. S.,	191.1
Muller, Edw., Jamaica H. S.	191.
Boeck, Alvord, Davenport H. S.	190.5
Ballard, R. W., Davenport H. S.	190.3
Harper, R. J., Evanston H. S.	190.3
Rorison, A. W., Davenport H. S.	190.3
Willard, F. S., Ridgewood H. S.	190.2
Wolfe, L. E., Business H. S.	190.2
Johnston, J.A.,Jr.,Springfield Tech. H.S.	190.
Woodworth, K. W., Springfield Tech. H. S.	189.9
Stokes, W. R., Business H. S.	189.8
Kamper, J. E., Evanston Township H. S.	189.6
Rouchere, H., Ridgewood H. S.	189.5
Simpson, Brad., Ridgewood H. S.	189.1
Benning, R., Jamaica H. S.	188.8
Zabriskie, P., Ridgewood H. S.	188.7
Bradley, F. M., Western H. S.	187.9
Blow, R. A., Lawrenceville H. S.	187.6
Rapelje, Jacob, Jamaica H. S.	187.6
Berrall, Lloyd, Western H. S.	187.5
Jockers, H., Jamaica H. S.	187.2
McCabe, Russell, Dinuba Union H. S.	186.5
Olmstead, Geo. Jr., Evanston Township H. S.	186.5
Dickson, R. B., Evanston Township H. S.	186.1
Johnston, M., Springfield Tech. H. S.	185.5
Zimmerman, D., Commercial H. S.	185.4
Schuster, A. W., Crosby H. S.	184.9
Waring, R., Evanston Township H. S.	184.9
Birch, F., Western H. S.	184.6
Bradley, F. C., Western H. S.	184.
Ackerman, H., Springfield Tech. H. S.	183.4
White, Jas., Ridgewood H. S.	183.3
Crammer, Gordon, Fresno H. S., 2nd Team	183.2
Gover, W. C., Red Bluff Union H. S.	183.1
Doran, J. N., Crosby H. S.	182.9
Gonzales, S., San Jose H. S.	182.5
Wilkinson, L., Evanston Township H. S.	182.2
Fitzpatrick, E., Tempe Normal H. S.	181.7
Pape, R. B., Crosby H. S.	181.6
Turrell, M., Crosby H. S.	181.4
Peterson, C. E., Lewis & Clark H. S.	181.2
Brown, Wm. T., Western H. S.	180.9
Dethlefsen, E. R., Watsonville Union H. S.	180.9
Holroyd, N. L., Crosby H. S.	180.9
Rothenberg, I., Commercial H. S.	180.9
Munson, E. L., Western H. S.	180.6
Burness, B., Fresno H. S.	180.

RIFLE TRAJECTORIES AT HIGH ELEVATION

(*Continued from page 14*)

it may be mentioned incidentally, the use of no less than 10,000 figures, despite the employment of logarithms in the endeavor to reduce the labour of computing.

The ballistic factors, etc., used in the calculation are as follows:

$$\text{Elevation} = \phi = 30°$$
$$\text{Muzzle Velocity} = V = 2{,}440 \text{ f.s.}$$
$$K\sigma = 0{\cdot}68. \quad C_\circ = 0{\cdot}382.$$

The difficulties of "small arc" calaculating are not great; rather do they consist in the laborious nature of the computing and the use of a little common-sense in certain necessary prognostications. A start is made by selecting the arc for computation, that is the portion of the trajectory whilst the inclination of the trajectory to the horizontal is changing from one angle to another. In rifle fire it is advisable to make the change in angle at first quite small, viz., 10 minutes of angle; larger differences are allowable as the trajectory calculation grows. The changes in angle used in the present calculation are shown in the first column of Table I.

Puting E for the initial elevation of the trajectory ($E = 30°$), and e for the inclination at the end of the first arc, and taking a 10 minute arc, we have, as the mean angle, E' of the arc,

$$E' = \frac{E + e}{2} = \frac{30° + 29° 50'}{2} = 29° 55'.$$

The next step is to make a guess at the height, h, which the bullet will rise in this arc. Familiarity quickly enables a guess to be made within a few feet, but it is sometimes necessary to repeat a calculation if a first "shot" at the height is wide of the real value. In the present case it is found that the height the bullet reaches whilst the bullet trajectory is changing in elevation from 30° to 29° 50' is 260 feet. The *average* height of the trajectory over the arc is then taken to be half this amount, that is 130 feet, and this tells us what value of the altitude f to use, employing the formula $f = 1 + 0.00003h$. The value of the altitude factor for each arc of the calculation is given in column 5 of Table II.

The C of the arc is the $fC_\circ = 0.382 \times 1.004 = 0.3835$. The pseudo-velocity at the beginning of the arc is given by the formula:

$$U = V \cos E \sec E'$$

wherein, replacing by figures we have,

$$U = 2440 \times 0{\cdot}866 \times 1{\cdot}1537 = 2438{\cdot}0$$

The pseudo-velocity at the end of the arc, u, is given by the formula:

$$I_{(u)} = I_{(v)} + \frac{(\text{Tan } E - \tan e)\, 2 \cos E'}{C}$$

which is found to give $u = 2060{\cdot}1$

The range on the horizontal (x) is then obtained by:

$$x = C \cos E' \left[S_{(v)} - S_{(u)}\right] = 452{\cdot}9 \text{ feet.}$$

The height of the trajectory, h, follows from this by using the formula

$h = x \tan E' = 452{\cdot}9 \times 0{\cdot}5754 = 260{\cdot}8$ feet

The time of flight, t, using the formula $t = C\,[T_{(v)} - T_{(u)}]$, is found to be 0·233-second, and the remaining velocity, v, which is also the intitial velocity of the second arc, is obtained by $v = u \cos E' \sec e = 2058{\cdot}4$ f.s.

A summary of the results obtained, calculated in the manner described above, is given in Tables I and II. Using columns 3 and 5 of Table I, which columns give the abscissae and ordinates of the trajectory, which as here illustrated to scale, presents to the eye the actual path of a Mark VII. bullet travelling under standard conditions of atmosphere, and under the ideal conditions of perfect stability and absence of "yaw." The presence of the two disturbing factors named, acting in the actual path of a bullet in flight, accounts for the inaccuracy in the calculated range. Under the "ideal" conditions the range of the bullet is seen to be 4,398 yards as against something round about 3,500 yards which is actually obtained.

The spade-work of the "ideal" trajectory having been performed, the figures may be examined leisurely with a view to seeing what may be done in order to reconcile theory with practice. It is not proposed to attempt to do this at this juncture but to leave the calculation as it stands in Tables I and II. so that other eyes may look upon the figures and make critical examination and, if possible, helpful suggestions as to what should be done to improve and rectify.

"H"—in *Arms and Explosives.*

THESE clubs have been admitted to membership in the National Rifle Association of America:

CIVILIAN RIFLE CLUBS.

Alaska:

Cordova Rifle Club. Sec'y, Roy I. Pell, Cordova, Alaska; Pres., Chester Mellison; Vice-Pres., T. N. Hubbert; Treas., Harry Achinson; Exec. Officer, Jack L. Downing. 41 members.

Arkansas:

Benton Rifle Club. Sec'y, E. A. Fowler, Benton, Arkansas; Pres., W. V. Evans; Vice-Pres., H. L. Dickinson; Treas., J. B. Crawford; Exec. Officer, John L. Hughes. 12 members.

California:

Los Molinos Rifle and Revolver Club, Los Molinos, Calif. Sec'y, G. H. Hayes, Los Molinos, Calif; Pres., R. E. Ludlum; Vice-Pres., W. B. Salisbury; Treas., V. A. Hardy; Exec. Officer, P. M. Pugh. 26 members.

Monterey County Rifle Club of Salinas. Sec'y-Treas., Victor A. Porter, Salinas City Bank, Salinas, California; Pres., D. B. Wylie; Vice-Pres., E. L. Hiserman; Exec. Officer Bert E. Underwood. 26 members.

Quincy Rifle Club. Sec'y F. R. Young, Quincy, Calif.; Pres. J. N. Stephan; Vice-Pres., M. C. Kerr; Treas., H. H. Bar, Exec. Officer, L. A. Braden. 61 members.

Richmond Rifle Club, Richmond, Calif. Sec'y, Earnest H. Brown, 1115 Chanclor ave., Richmond, Calif.; Pres., C. H. Weden; Vice-Pres., Aaron P. James; Treas., S. H. Gnaga; Exec. Officer, E. K., Gillett. 12 members.

San Louis Obsipo Rifle Club. Sec'y, G. W. Fitzgerald, 1024 Chorro st., San Luis Obsipo, Calif.; Pres., Roy A. Lind; Vice-Pres., Chas. Eastman; Treas., E. L. Elberg; Exec. Officer, Homer Elliott. 34 members.

Colorado:

Edwards Rifle Club. Sec'y, Rolla C. Prater, Avon, Colorado; Pres., C. V. Norgaard; Vice-Pres., James Breet; Treas., H. K. Brooks; Exec. Officer, J. D. Marquiss. 12 members.

Trust Company Rifle Club of Colorado Springs. Sec'y, Miss Ruth Mitchell, care of Colorado Title & Trust Co., Colorado Springs, Colorado; Pres., Paul Bossart; Vice-Pres., R. Willis Mahee; Treas., Walter W. Udick, Exec. Officer, A. N. Nydegger. 12 members.

Connecticut:

Deep River Rifle Club. Sec'y, Proal Judson, Deep River; Pres., Wm. M. Morton; Vice-Pres., Arthur E. Carlson; Treas., Harvey J. Brooks; Exec. Officer, Capt. Harvey A. Moore. 55 members.

Hawaii:

Hamakua Rifle Club, Honokaa, Hawaii, T. H. Sec'y, F. R. H. Fraser, Honokaa, Hawaii, T. H.; Pres. Wm. J. Payne; Vice-Pres., Fred R. Giddings; Treas., A. O. Henderson; Exec. Officer, George S. B. Ferguson. 21 members.

Idaho:

Kamiah Rifle Club. Sec'y, Leslie L. Roth, Kamiah, Idaho; Pres. J. F., Bridwell; Vice-Pres., R. G. MacLaughlan; Treas., Ward L. Dempsey; Exec. Officer E. W. Renshaw. 70 members.

Iowa:

Muscatine Rifle Club. Sec'y, Geo. Birrell, care of Geo. Birrell & Co., Muscatine, Iowa.; Pres., Edward A. Roach; Vice Pres., C. S. Stafford; Treas., Byron McKee, Exec. Officer, Chas. Robinson. 80 members.

Kansas:

Clay Center Rifle Club. Sec'y, A. Buchman, Jr., Clay Center, Kansas; Pres., John Berglund; Vice-Pres., Osccola Prather; Treas., R. Brueggeman; Exec. Officer Will Nordstrum. 37 members.

Massachusetts:

Needham Rifle Club. Sec'y, Lloyd Worthington Litchfield, Dedham ave., Needham, Mass.; Pres., T. J. Crossman, Jr.; Vice-Pres., R. J. Rutledge; Treas., J. Worth Brownville; Exec. Officer, Walter K. Queen. 263 members.

Michigan:

Corp. Jas. W. Johnson Post No. 78, Veterans of Foreign Wars Rifle Club of Detroit. Sec'y, H. J. Nelson, 312 Cass ave., Apt. 9, Detroit, Mich.; Pres., Edwin J. Clark; Vice-Pres., Harry Simpson; Treas., Charles D. Lehmkulm; Exec. Officer, Walter C. Catlin. 10 members.

Minnesota:

Patrick Gallagher Post No. 205, Veterans of Foreign Wars Rifle Club, St. Paul. Sec'y. William C. Buckley, 334 4th ave., So. St. Paul, Minn.; Pres., Walter B. Lanegran; Vice-Pres., Floyd V. Nichols; Treas., Max Schlesinger; Exec. Officer, Wm. K. Follmer. 15 members.

Montana:

Broadview Rifle Club. Sec'y, B. King Powell, Broadview, Mont., Pres., Otto H. Bundy; Vice-Pres., J. Harold Cope; Treas., Frank O. Galles; Exec. Officer, Clarence W. Weltzin. 30 members.

Rosebud Rifle Club. Sec'y, W. W. Wahl, Rosebud, Mont.; Pres., J. D. Hargraves; Vice-Pres., J. Amundson; Treas., W. L. Kennedy; Exec. Officer, H. Tilleson. 26 members.

Selmer Oie Post 173, Veterans of Foreign Wars Rifle Club of Scobey. Sec'y, Paul Crum, Scobey, Mont.; Pres., Fred I. Davis; Vice-Pres., Charles V. LaFavor; Treas., A. L. Brunet; Exec. Officer, Brudo Grorud. 12 members.

New Jersey:

Frank J. Van Wetering Post No. 316, Veterans of Foreign Wars R. C. of Hackensack. Sec'y, W. A. Sweeney, 316 Union st., Hackensack, New Jersey; Pres., Clayton Lambert; Vice-Pres., Edward Lambert; Treas., Louis Krause; Exec. Officer, L. Goettscheus. 31 members.

Lt. Leslie J. Rummell Post 164, Veterans of Foreign Wars Rifle Club of Newark. Sec'y, Henry Lange, 290 Leslie st., Newark, N. J.; Pres., John Mulligan; Vice-Pres., John A. Cooper; Treas., David Blum; Exec. Officer, Dr. Leonard S. Moray. 13 members.

New York:

Camp Fire Rifle Club, Millwood. Sec'y, Parker Syms, 361 Park ave., New York, N. Y.; Pres., T. Charles Farrelly; Vice-Pres., David T. Abercrombie; Treas., Karl T. Frederick; Exec. Officer, Alex D. Walker. 32 members.

Dexter Rifle Club, New York. Sec'y, Sanford Brass, Dexter, N. Y.; Pres., James Lee; Vice-Pres., Alfred Emerson; Treas., E. R. Eveleigh; Exec. Officer, Fred L. White. 25 members.

Fonda Rifle Club. Sec'y, Gail Bowler, Fonda, N. Y.; Pres., John V. Veeder; Vice-Pres., Homer H. Blunck; Treas., E. C. Payne; Exec. Officer, John V. Veeder. 11 members.

Victor H. Bridgman Post No. 44, Veterans of Foreign Wars Rifle Club of Brooklyn. Sec'y, Albert Schultz, 214 Walworth st., Brooklyn, N. Y.; Pres., Don C. St. John; Vice-Pres., David L. Spoung; Treas., Herman T. Augenstein; Exec. Officer, John J. McEntee. 425 members.

Pennsylvania:

George Raymond Craft Post, No. 256, Veterans of Foreign Wars R. C. of Loc Four. Sec'y, Louis Brown, 435 Fall ave., Charlevoi, Pa.; Pres., Arnold J. Walter; Vice-Pres., Edward J. Geho; Treas., John P. Landerbough. 12 members.

James L. Noble Post, No. 3, Veterans of Foreign Wars R. C. of Altoona. Sec'y, J. L. Bosserman, 623 4th ave., Altoona, Pa.; Pres., J. H. Shearer; Vice-Pres., F. W. Sawtelle; Treas., H. H. Glass; Exec. Officer, W. H. Hay. 15 members.

Lt. Gen. Hunter Liggett Post, No. 38, Feterans of Foreign Wars R. C. of Reading. Sec'y. E. T. Lachman, 1534 Haak st., Reading, Pa.; Pres., S. Lunine; Vice-Pres., H. I. Degler; Treas., H. Esterline; Exec. Officer, F. Sebest. 10 members.

Menoher Post, No. 155, Veterans of Foreign Wars R. C. of Johnstown. (McAtee Bldg.) Sec'y, Robert F. Miller, 345 Strayer st., Johnstown, Pa.; Pres., Charmer Holsinger; Vice-Pres., Frank B. Chiles; Treas., George F. Ray; Exec. Officer, Charles L. Sakon. 10 members.

Sgt. Temple Post, No. 32, Veterans of Foreign Wars Rifle Club of South Fork. Sec'y, Raymond J. Carroll, South Fork, Pa.; Pres., Vincent A. Stanton; Vice-Pres., William Casey Treas., William Chappelle; Exec. Officer, William Clifford. 7 members.

Texas:

Franciscan Mission Pistol & Rifle Club, San Antonio. Sec'y, Harvey Cunningham, 326 W. Commerce st., San Antonio, Texas; Pres., Joseph C. Bolner, Jr., Vice-Pres., Valentine Maspero; Treas., Dave Bolner; Exec. Officer, Dave Maspero. 59 members.

Utah:

La Sal Rifle Club. Sec'y, W. I. Smith, La Sal, Utah; Pres., John M. Fisher, Vice Pres., Geo. A Branson; Treas., W. I. Smith; Exec. Officer, Henry Stokes. 15 members.

Washington:

Entiat Rifle Club. Sec'y, J. E. Gipe, Entiat, Wash.; Pres., J. H. Auvil; Vice-Pres., B. F. White; Treas., W. R. Goodman; Exec. Officer, R. O. Small. 14 members.

Walla Walla Rifle Club. Sec'y, A. T. Gilhus, Walla Walla, Wash.; Pres., G. G. Schneller, Vice-Pres., W. C. Hanger; Treas., Val Jensen; Exec. Officer, Chris Jensen. 14 members.

Wenatchee Rifle Club. Sec'y, A. E. Schaller, Wenatchee, Wash.; Pres., J. C. Hazlett; Vice-Pres., J. C. Burns; Treas., R. G. Stiles; Exec. Officer, W. Martinson.

Wyoming:

Cheyenne Rifle Club. Sec'y, John A. Krick, 1610 Warren ave., Cheyenne, Wyo.; Pres., W. E. Spence; Vice-Pres., Tom Kirk; Treas., C. W. Slagle; Exec. Officer, W. C. Liner. 48 members.

Laramie Rifle Club, Laramie, Wyoming. Sec'y, R. L. Murphy, Co. Box 421, Laramie, Wyo.; Pres., Frederick Frick; Vice-Pres., Charles DeHart; Treas., J. Frank Squires; Exec. Officer, Don Hays. 70 members.

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COLLEGE CLUBS

Michigan:

University of Michigan Rifle Club, Ann Arbor, Mich. Sec'y, Archibald Wenley, 509 E. Madison st., Ann Arbor, Mich.; Pres., Robert Tubbs; Vice Pres., Robert S. Moore; Treas., Robert Ball; Exec. Officer, George M. Gilmore. 38 members.

Alabama:

Alabama Presbyterian College Rifle Club, Anniston. Sec'y, Edgar G. Billingsley, Alabama Presbyterian College, Anniston, Ala.; Pres., Dr. David Perk; Treas., Clyde C. Carmichael; Commandant, Harlee Morrison. 46 members.

Pennsylvania:

Pennsylvania State College Rifle Club of State College, Pa. Sec'y, Karl G. Graf; pres., Palmer E. Harding; Vice-Pres., James E. Atherton; Treas., Albert S. Barnhart; Exec. Officer, Clifton E. Mowrer. 41 members.

SCHOOL CLUBS

Alabama:

Southern Military Academy Rifle Club, Greensboro. Sec'y, Col. W. E. Mould' Southern Military Academy, Greensboro, Ala.; Pres., Capt. Garg; Vice-Pres., Cadet R. M. Shores; Treas., Col. F. C. Shaw; Exec. Officer, Cadet Capt. Milton Green. 71 members.

Massachusetts:

Northampton High School Rifle Club. Sec'y, Sheldon N. Coit, 35 Vernon st., Northampton, Mass.; Pres., Francis M. Hennessy Treas., J. A. H. Crosier; Captain, John D. Churchill. 26 members.

Virginia:

Fishburn Military School Rifle Club of Waynesboro. Sec'y, John M. Bower, care of Fishburn Military School; Pres., Henry A. Lineberger; Vice-Pres., Holt W. Butt; Treas., H. Oliver Cheshire; Exec. Officer, Julius L. Bunting. 129 members.

BOY'S CLUBS

Indiana:

Greentown Junior Rifle Club. Sec'y, John Hunt, Greentown, Indiana; Pres., A. F. Allen; Vice-Pres., La Von McCoy; Treas., John Ellis Fell; Exec. Officer, Clarence La Follete. 10 members.

LIFE MEMBERS.

George V. Martin, 7706 Platt ave., Cleveland, Ohio.

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J. R. Mattern, Julian, Pa.

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M. H. Truesdell, Box 872, Juneau, Alaska.

L. D. Bolton, 2215 Dime Bank Bldg., Detroit, Mich.

L. H. Siegel, Marshfield, Ore.

L. W. Kolstrup, Fallon, Nev.

Oscar Waymire, Howe, Idaho.

E. L. Mills, 929 North Main st., Los Angeles, Calif.

Loads And Re-loads

In this column, conducted by Capt. Townsend Whelen, will be answered inquiries pertaining to target and hunting small arms, hunting licenses, game guides, and kindred subjects. An effort will be made to reply to inquiries direct by mail before the appearance in this column of the answer. The service is free to all, whether the inquirer is a subscriber to Arms and the Man or not. All questions are answered at length by mail. Those portions of general interest are published here.

WE contemplate building a "V-rest" of the Mann type. This will be used by members of our club in testing various rifles and ammunition. Our plan is to make a stationary base and portable "V-rest" so that we can carry the "V" back and forth from the range.

If possible we want to use a piece of heavy Angle Iron, 30 inches in length, about 4 inches across the "V" and about 2¾ inches deep. This will be polished on the inside surface of the "V". Two four-inch steel rings will be turned out with an inside diameter of two inches. Split bushings of Maple, slightly tapered, will be used to hold different sizes of barrels in the rings. One of the steel rings will be flatted to fit the "V" so that the barrel will not rotate. Three 4 x 6 posts will be sunk in the ground to a depth of three feet and the "V-rest" bolted to them securely.

If these ideas are not practical, we will have a "V-rest" made of cast iron, very heavy, and bolt it to a more substantial foundation. We wish to use the lighter construction if possible, on account of the portability. Will you kindly advise us if these ideas are practical and if such a rest would be successful?

B. G. S., Des Moines, Iowa., R. C.

Answer: Relative to the Mann rest: In the first place, have you seen the article and illustration on the Ordnance Department adaptation of this rest that appeared in *Arms and the Man* of April 15th? There are some very good suggestions in it.

I would certainly put this V-rest on a solid concrete base and would not trust the wooden posts at all. My own impression is that the V of the Ordnance Department rest is not long enough. I should prefer it 40 inches instead of 30 inches.

You speak of having one of the steel rings flattened to fit the V so that the barrel will not rotate. This will not work at all. The barrel has to rotate when it is fired, this rotation being caused by the twist of rifling. If you attempt to restrict this by flattening the ring, I think that your barrel will probably jump out of the V when it is fired. We usually place a chalk mark on one of the rings, and always have this uppermost when firing.

I would also suggest that you make construction as heavy as possible, and then to protect the whole thing have a sheet iron cover which will go over the V rest and lock down onto the concrete base, so that no one will disturb anthing on the days when you are not using the V-rest. I presume, of course, that you have a copy of Dr. Mann's book "The Bullet's Flight".

WILL the '06 Springfield shell be as accurate when loaded with the Krag 220-grain metal case bullet and the standard load of DuPont No. 16, hand weighed powder charges? How will it compare with service ammunition up to 600 yards. I have a quantity of Krag bullets on hand and would like to use them up in the Springfield if they will chamber properly. What would be the proper depth to seat this bullet? Using this bullet in the Krag please give me a short-range load for DuPont No. 75 or 80.

P. A. K., Phoenix, Ariz.

Answer: Replying to inquiries concerning the use of 220-grain metal cased bullets in the Springfield shell: These bullets can be used satisfactorily provided they will chamber correctly. Some of them are so thick at the point that they will not enter the throat of the chamber. The only way definitely to determine this is to try the bullet in a shell and see if it will seat. Some will and some will not. It should be loaded in the shell to such a depth that the cartridge over all will have the same total length as the regular Springfield cartridge. It will then work correctly through the magazine.

For this bullet in the Springfield shell you can use the following charges:

43 grains of DuPont No. 20, velocity 2,200 feet per second.

46.5 grains DuPont No. 18, velocity 2,350 feet per second.

43 grains of DuPont No. 16, velocity 2,206 feet per second.

45 grains of DuPont No. 16, velocity 2,300 feet per second.

I am inclined to think that the first mentioned charge will give you the best accuracy.

In a good rifle and well loaded, such ammunition should give six inch groups at 200 yards, and I think it ought to be good for scores of 47 at 600 yards. The recoil will be a little bit more than with the regular Springfield charge; also at ranges over 200 yards it will require a little more elevation than the service charge.

I have never tried this bullet with No. 75 or 80 powder. It should shoot, however. I would suggest trying about 25 grains of No. 80. If this seems to expand the base of the shell, cut it down a little bit; or, if you want a higher velocity, run up your charge gradually until the shell seems to expand a little and then decrease a grain or two from the charge which expanded the base of the shell.

IN remodeling a Springfield 1903 into a sporter, is it best to remove rear-sight base or to have it turned down and leave it on the barrel?

I had thought of using a band on fore-arm something like used on 1895 Winchester carbine as I do not want to slot barrel.

Would like to know if there is anyone besides Mr. Newton that makes a leaf sight that fastens round the barrel with a band.

I am using a Lyman No. 48 rear sight on my gun but have just sent a bolt and cocking-peice to the Lyman people to have a No. 103 fitted and will use the one that suits best. I have hunted considerable in Arizona, New Mexico and Northern Mexico but always used a Winchester but since I started shooting on the rifle range have learned to like a Springfield better than any gun I ever used.

I don't like the sights and clumsy stock for hunting. I like an open or peep close to the eye and like to aim where I expect bullet to hit.

I. H. B., Clarkdale, Ariz.

Answer: I would recommend that you remove the rear sight face and have the barrel polished and then blued. I think a forearm band like that on the 1895 Winchester carbine is the very best way of attaching the forearm piece to the barrel.

I do not know of anybody except the Newton Arms Co. who makes the leaf sight with a barrel band. Both the Lyman No. 48 and 103 rear sights are excellent. The No. 103 is best for hunting as it can be seen in poorer lights and is a quicker sight. It is, however, too near the eye to use in the standard military prone position. For military prone shooting the best sight is the No. 48.

IF IT is not too much trouble, I wish, at your convenience, that you would write me and state whether or not you would advise boring holes in the base of this stock in order to lighten it; also give me your idea of the best way to carry a jointing ramrod in the stock.

J. G. M., Erie, Pa.

Answer: It will do no hurt to bore holes in the base of your stock to lighten it provided these holes do not extend up into the grip, which should be kept as strong as possible. It is hard to bore holes in the stock for a jointed ramrod without having these holes run up too far. I would suggest carrying a field cleaner in the stock and letting the jointed ram rod stay in your ruck sack.

I HAVE some powder from Frankford Arsenal; Lot No. 408 for .30 calibre Model 1906, and I would like to know how many grains of this should be used in loading a .30 calibre U. S. Krag shell with the 172-grain Newton bullet.

H. G. L., Red Bluff, Calif.

Answer: I am in receipt of your letter of the 30th ultimo relative to the use of powder marked Frankford Arsenal, Lot No. 408 for .30 calibre Model 1906. This is evidently Pyro DG Powder, known to the trade as DuPont Military Rifle Powder, No. 20.

For use in the .30-40 cartridge in the U. S. Magazine Rifle calibre .30, Model of 1898 (Krag), with 172-grain Newton copper jacketed bullet I would advise that you use 37.5 grains weight, which will give you a velocity of approximately 2,300 feet per second, with a breech pressure of about 36,900 pounds. This charge will be found very satisfactory for both target and game shooting.

A NEW score book, based upon the latest small arms firing regulations of the U. S. Army has just been published by the U. S. Infantry Association, Washington, D. C. The new publication, known as "The Infantry Score Book contains all of the up-to-date "dope" on military rifle shooting. It is understood that the edition of the old Small Arms Firing Manual of 1913 is entirely exhausted; the new volume—"The Soldier's Handbook of the Rifle" has not yet appeared; in the interim, the Infantry Score Book may be found valuable by militiamen for use during the present season and until the new government regulations are ready for distribution.

UPON application to the Director of Civilian Marksmanship, individual members of the National Rifle Association may purchase a second-hand, re-finished and serviceable carbine, calibre .30, model 1899, for $5.00. Bank drafts, certified checks or money-orders made payable to the Director of Civilian Marksmanship should accompany each request.

Ammunition for Krag carbine may be issued to clubs free of charge until the present supply on hand in the Ordnance Department is exhausted, after which shells can be re-loaded by clubs. There is on hand at present a supply of this ammunition which can be purchased through the Director of Civilian Marksmanship at $18.00 per case of 1200 rounds.

WHERE can I obtain a Krag Carbine, M'99? I have written Springfield Armory, but was informed that they had none for sale.

Can the Lyman No. 48 Receiver Sight be used with this arm?

What has been you experience with reduced loads in this arm as compared with the Krag Rifle i. e., is a deflection correction necessary from the sight setting used with the full charge?

S. M. T., U. S. A.

Answer: I think that as an army officer you can obtain a Krag Carbine for five dollars from the Commanding Officer, Watervliet Arsenal, Troy, N. Y. A good gunsmith can place a No. 46 Lyman receiver sight on this rifle. I have one on a Krag rifle of my own, which has been placed on the left side of the receiver and the eye piece on the sight reversed. This is very satisfactory, but the magazine cutoff has to be eliminated.

Reduced loads work very satisfactorily in a Krag carbine; in fact, just as well as in a rifle. With all reduced loads the windage deflection correction is necessary, even more so than with the model No. 1903 rifle, on account of the bolt being separated by only one locking lug. It amounts to about one point of windage, that is, 6 inches at 100 yards. Of course you will have to find the exact amount by experiment.

IS THE Remington 101 gr. M.C. bullet, as made for the Remington .25 applicable to the Savage 250-3000 Bolt Action? If so, what are the ballistics with maximum powder load?

E. D. C., St. Louis, Mo.

Answer: The 101 grain Remington jacketed bullet will not work satisfactorily in the Savage .250 rifle. The Twist of rifling is too slow to handle this bullet.

THAT Benjamin Franklin was a conservative in matters military, that he opposed the introduction of means of warfare which proved to be quite practical, and that he wrote a letter to Charles Lee in February, 1776, advocating the retention of bows and arrows, are the sensational accusations presented to Congress by Representative Dowell recently.

The charges were supported by evidence. The representative read the letter which is as follows:

"But I still wish, with you, that pikes could be introduced, and I would add bows and arrows. These were good weapons not wisely laid aside.

"(1) Because a man may shoot as truly with bow as with a common musket.

"(2) He can discharge four arrows in the time of charging and discharging one bullet.

"(3) His object is not taken from his view by the smoke of his own side.

"(4) A flight of arrows, seen coming upon them, terrifies and disturbs the enemy's attention to their business.

"(5) An arrow, striking in any part of a man, puts him hors du combat till it is extracted.

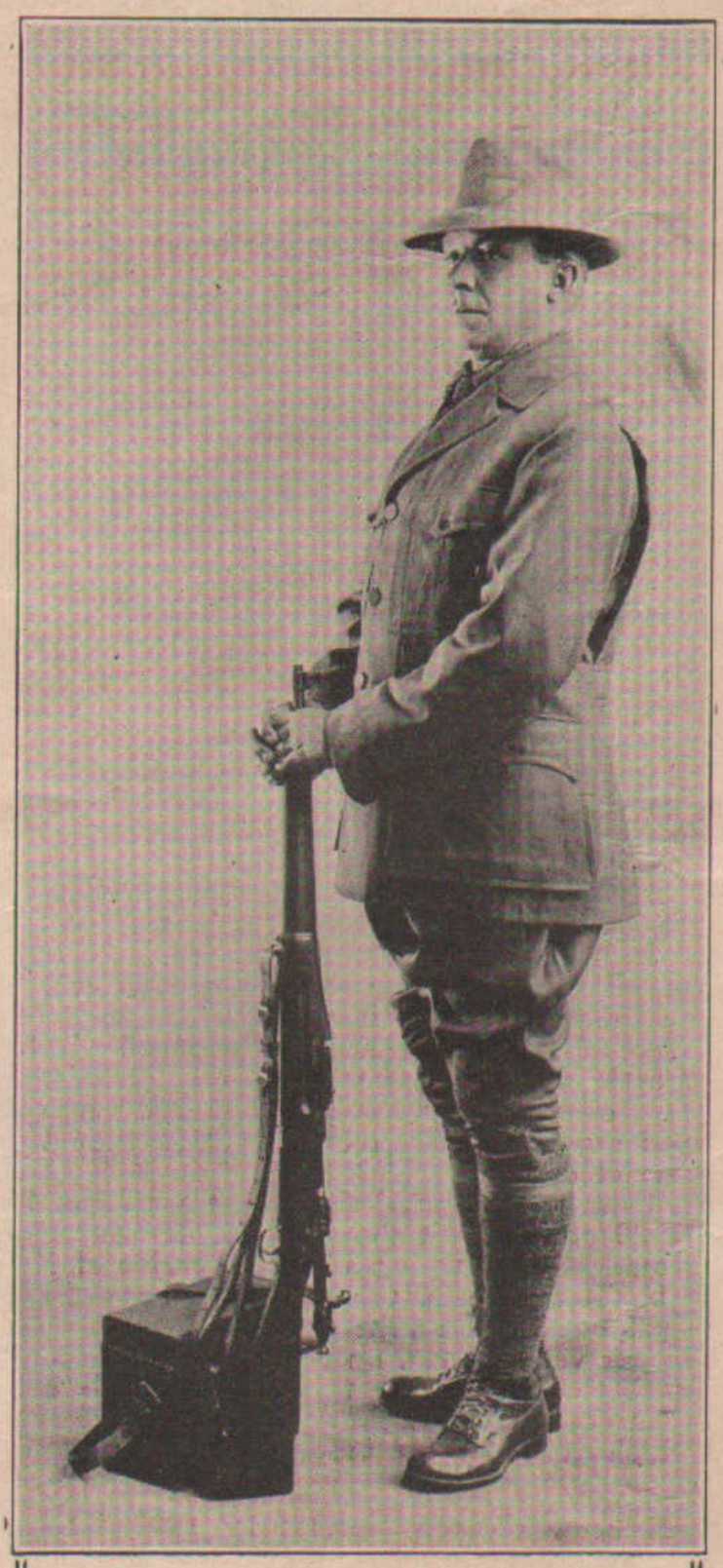
"(6) Bows and arrows are more easily provided everywhere than muskets and ammunition."

The investigation is not to be continued further. The representative was merely trying to convince members of the House that liberal views regarding aviation possibilities are in order.

IS there any one substance, or oil, which will positively remove fouling by powder or lead from inside of rifle barrel, and which can also be trusted to prevent rust when arm is put away, for a year or so?

S. I. K., East Oakland, Calif.

Answer: The only substance which will clean a rifle barrel completely in one operation, without any danger of subsequent rusting if put away and given no other attention, is ammonia. The rifle should be treated with the regular metal fouling ammonia solution, as described in the Ordnance Handbook on the Springfield Rifle, in the Small Arms Manual, or in my own book, The American Rifle.



WANTS AND FOR SALE

Each subscriber to ARMS AND THE MAN is entitled when his subscription is paid up for one year, to one free insertion of a half-inch want ad in this column.

All he needs to do is to send in the advertisement for insertion at the same time calling attention to the date when his subscription was paid.

OLD-TIME and modern firearms bought, sold and exchanged. Kentucky flint-lock rifles, old-time pistols, revolvers, guns, swords, powder horns, etc. Lists free. Stephen Van Rensselaer, 805 Madison Avenue, New York City.

FOR SALE—1903 Springfield rifle, OK condition inside and out, barrel formerly owned by W. A. Tewes who said best he ever used, up to 1,200 yards; also Lyman No. 48 Micrometer Windgauge sight (not attached) and 156 rounds ammunition by U.S.C.Co. First check for $50.00 takes all. 1 Winchester Musket 22 L.R., good condition, factory sights, $18.00. Send stamp with inquiry please. Clayton H. Waite, Box 588, Springfield, Vt.

WANTED—Two Springfield .30-06 rifles, prefer sporting stocks. 38 Sp'l, reloading tools. R. H. Brumfield, Bluffton, Ind.

FOR SALE—Krag Rifle, new, one old barrel good shape, belt, loading tool, 300 empties. Price $25.00. J. J. Rohlk, 1210 Brown st., Davenport, Iowa.

FOR SALE—A 22 Cal. Springfield, made over by A. O. Neidner and fitted with 14 Power Telescope with Neidner blocks. An extremely accurate target outfit, a gun that would be appreciated by a particular shooter. Price, $150.00. W. E. Fennell, 160 Congress, st. Boston, Mass.

FOR SALE—Savage N.R.A. Bolt Action .22 L.R. rifle; six magazines, new, perfect condition. $25.00. Dr. M. E. Bachman, 412 Hippee Bldg., Des Moines, Iowa.

FOR SALE—Winchester Palm Rest, $3.00; Rifle Butt Plate for Winchester Schuetzen, $1.50; burly walnut stock Blank Schuetzen, $3.00; Ideal molds, .30, Nos. 308284 and 308329, each $1.25; .25-20 mold 257312, $1.25. All fine. 1,000 .30 gas checks, $2.00; 500 .25 gas checks, $1.00. W. R. Thompson, Ebensburg, Cambria Co., Pa.

FOR SALE—.22 Cal. Long Rifle, Winchester, Lever Action Musket, in perfect condition. Krag Service rear sight, Lyman globe Aperture and Bead front sight, also fitted with block to receive telescope. Will ship C.O.D. subject to examination. $25.00. Harry A. Sleeper, Claremont, N. H.

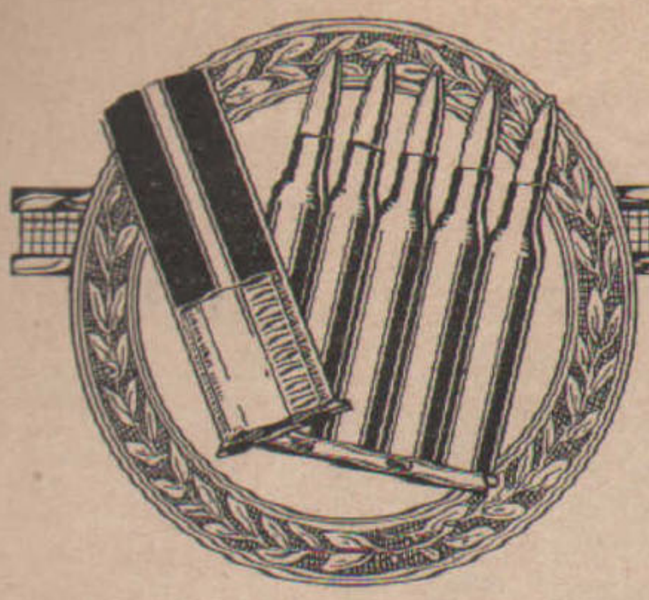
WANTED—One 10 or 12 power Rifle Telescope, any mounting. D. W. Van Vleck, 1709 22nd st., Superior, Wis.

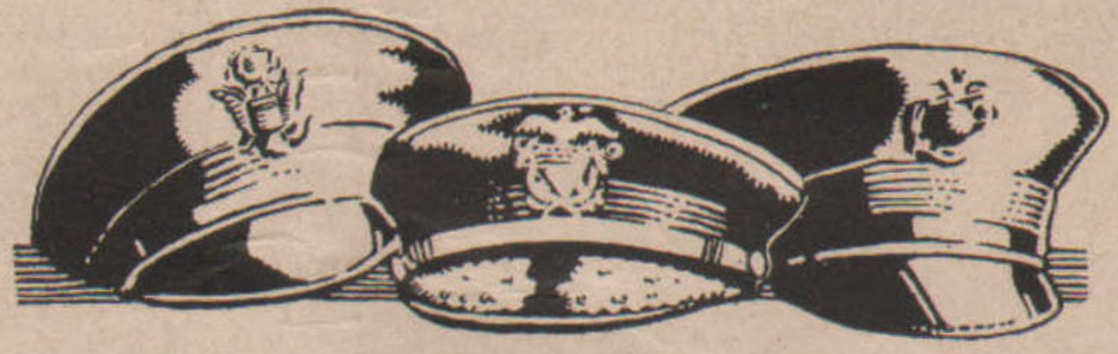
WANTED—.22 Cal. Springfield in good condition. Must be cheap. Also want .22 cal. target pistol or revolver. V. Fabian, 7150 Eggleston ave., Chicago, Ill.

WANTED—Old ONE VOLUME edition of "The Book of Camping and Woodcraft" by Horace Kephart. State condition and price. Campbell Watson, care of Philadelphia Trust Co., Liberty Bldg., Philadelphia, Pa.

RADIUMIZED LUMINOUS SIGHTS now ready for the .45 Colt Automatic Pistol; also for Lyman No. 1 and similar stem rear sights and Lyman ivory bead and similar front sights. Snap on and off instantly. Send postpaid on approval for $3.50, with money back guaranty if dissatisfied. E. F. Watson, Dumont, N. J.

FOR SALE—.22 Cal. Colt automatic, .38 Cal. Colt Army Special 6" blued, absolutely new. 10% discount from retail price. Also splendid .45 Colt Automatic complete with new U. S. pattern holter, belt, leather magazine pouch, two extra magazines, and 400 rounds ammunition. $55.00 for lot, cost $65.00. Absolutely new Krag Carbine never fired, M-99, $20.00. Springfield in new condition, with exception of slightly pitted barrel, $24.00, still quite accurate. Miners Assay scales $6.50. NO TRADES. Two or three other real bargains. T. C. Barrier, Box 52, Statesville, N. C.





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WINCHESTER

1866 1920

Winchester .410 Caliber Family Shotgun

TRAPSHOOTING FOR THE FAMILY

AN entirely new family recreation—wholesome, invigorating, and very enjoyable—comes into the family circle along with the new Winchester Junior Trapshooting Outfit. The neat and handy kit which equips you completely for junior trapshooting.

See it at your local hardware or sporting-goods store. You will notice at once that it is built for service—a practical unit for modified trapshooting, with full instructions.

Try the Winchester .410 calibre Family Shotgun at your shoulder. Test its fit and balance. Note the usual Winchester construction and finish—from butt-plate to muzzle, an example of good gunmaking. We believe that the more you know about guns the better this one will please you, especially when you consider it as a family gun.

Examine the little .410 calibre Shot Shells—made exactly like the Winchester standard trapshooting shells. Fired in the new Winchester .410 bore Family Shotgun, they give in reduced form the same target pulverizing shot pattern for which the larger Winchester Shotguns and Shells are so popular.

Inspect the new Winchester Junior Hand Trap. This interesting device, with which anyone can send the Midget Targets soaring—just like the regular clay "birds" at a trap shoot—is itself a source of good fun.

ALREADY POPULAR

Almost any boy or girl old enough to shoot a small rifle can handle the little .410 Shotgun, and will do so with delight. Any woman who would like to shoot and is not afraid of a golf club, a tennis racket, or a pair of skates, will take up the sport with surprising interest and pleasure. The *kick* and the *bang* have been so largely eliminated that they are hardly noticed.

Men and boys used to shooting larger shotguns are even more enthusiastic. Hitting the speedy Midget targets is good practice too, for nearly every kind of shooting.

TAKE IT ALONG ALWAYS

There is much more pleasure on an outing by automobile, canoe, or boat, if you slip your handy W.J.T. case under the seat. And with proper care your gun and trap will last indefinitely.

Let everybody shoot at the same number of targets. Arrange handicaps and keep scores. Then see how enthusiastically all will look forward to *next* time.

Take a Winchester Junior Trapshooting Outfit home with you today. If your dealer cannot supply you, write to us for complete information and the address of one who can.

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