

March 24, 1965

Mr. Carl E. Swanson
4 Vista Road
Englewood, Colorado 80110

Dear Carl:

I was certainly happy to receive your letter the other day and am most happy to answer the questions concerning guns and gun design.

First of all, on your Model 1100 Trap Gun, we do a special operation on the fire controls to tune up, so to speak, the trigger for all of the trap guns. I will send you a fire control along with a new forearm, and would appreciate if you would advise me as to how the fire control performs. In the meantime, please send me your fire control as I would like to investigate it more closely and then perhaps I can advise you as to what should be done to correct the problem.

As far as the forearm is concerned, I haven't the slightest idea what grade of wood your shotgun contains. However, if the forearm I send you does not match, then send me your old one and I will try to get a better match for it.

As to the modified choke, it would best be ordered through your local dealer.

Approximately 90% to 95% of all of our barrels are interchangeable in our M/1100 shotguns. But when you get your shotgun barrel, check with the headspace gauges that I know you must have in the school to see that they will accept a min. and not accept a max. gauge. If you have trouble in this area, please advise.

Now as to the strength of bolt action rifles. This is a subject that I enjoy talking about, as there have been so many myths and opinions in the past and at present with claims made, some based on fact and others on opinions again, that you should get the true known facts so that the boys in your school will not be misled.

As I probably related to you, my basic experience in gun development started at the Aberdeen Proving Ground where I set up the tests for all of our small arms military weapons during the war. And my first job here at Remington after that

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experience was to do the same thing for the Remington. And I will say here that our tests are much more stringent at Remington than they are with the military, both endurance-wise and function-wise.

As far as the functional aspects are concerned, our shotguns are subjected to tests upwards of 35,000 to 50,000 rounds each with a careful check being made on every round that is fired. We shoot them from the various types of shoulder resistances which cover the spread of all humans, light and heavy. We involve them in all kinds of shooting conditions; rain, ice, snow, extreme cold conditions down to 40° below, with extreme high pressures. Then drying the guns out to a point of very low humidity and subjecting them to considerable amount of oil, all of which add up to a very thorough test on our shotguns. Basically, our rifles go through the same thing, but in addition even though the shotguns are subjected to handloads of various descriptions, the rifles are the ones that really get the works.

The first really high pressure strength test, I believe, that was ever conducted on a center fire rifle was that conducted on the Model 721. Now I know in the past that higher pressure tests have been conducted on rifles, but they mainly involved those tests with steel cases such as General Hatcher conducted in the Springfield Armory. The basic item to consider here is the fact that with all rimless cases the cartridge is unsupported in the rear section; and therefore the strength of the gun is dependent upon the strength of the cartridge case. Oh, I admit that lugs, barrel dimensions, etc. are important. But there is no rifle in the world that will contain a ruptured cartridge case that is unsupported because of its lug size. For one must remember that the pressure generated in a cartridge and in the chamber section is pounds per square inch, and once a cartridge ruptures in the rear section or the primer pocket opens up, the pressure there escapes rearwardly, and works on every area that is exposed to it. And pounds per square inch can really build up to astronomical proportions that will take any of these guns apart.

So the secret, therefore, is not in the strength of a rifle, and not to depend entirely on the strength of the cartridge case, but to support it so that it cannot escape these high pressures rearwardly into the action. This is just exactly what was done in the Model 721. The tolerances were held close enough that the expansion of the cartridge case into the shroud of the bolt was small enough that only the primer pocket could expand to a small degree, allowing enough gas rearwardly to cock the firing pin and that was all. The shroud in turn was supported by a recess in the barrel, which in turn was supported by the receiver.

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Now to give you an example of how far we conduct our tests. We worked up from a proof load which generally is about 2.7 grams of 4198 powder in a 30-06, and by the way the 30-06 combination is the most potent of all. The first super proof loads which were 3.2 grams of 4198 powder were tested in all existing rifles including the M/721. A few of the rifles blew up at this pressure level; such as the Springfield, Japanese Arisaka, and others of weaker design. In this particular instance, 3.2 grams of 4198 powder were developing pressures upwards to 100,000 ppsi, and actually the brass case is not strong enough to accommodate anything much over 80,000 ppsi unsupported. The M/721 went through at this point with flying colors.

We then started to ramming bullets in the 220 grain category ahead of the chamber, not allowing of course any space between the protruding bullet of the existing pressure round and the jammed bullet ahead of it, as this would split barrels, if the space was between these two elements. The M/721 continued on up to five 220 grain slugs ahead of a 3.2 gram load. The pressures were so high after 2 slugs in front of the cartridge that at that time we had no proper measuring equipment, and only estimates and calculations could be made. However, it has been later determined that we have reached somewhere in the neighborhood of 300,000 to 400,000 ppsi in these rifles. The end result, of course, is that the cartridge swells to the limit of the shroud and a little beyond as all of the clearances are taken up between the shroud and the barrel, and the barrel and receiver. And in a sense the cartridge, the bolt shroud, the barrel, and the receiver are welded together in an integral piece. It would be, and was, impossible for us to extract any portion of these parts from the other, and the only way examination could be made was to cut the section in two, right through the front face of the bolt, and there one could see a good example of high pressure forming, or explosive forming, as it was impossible to distinguish where the shroud in the barrel and the receiver joint were.

Now what happened to those slugs that were in the barrel. Well, in most cases they all fired out of the barrel and of course in all cases the stock was shattered to shreds. But I'll give you one example that caused my dear friend, General Hatcher, who was here at the time during the tests, to consider some of the basic laws of physics. One day we had a 5 slug 3.4 gram of 4198 powder loaded in a M/721 and this all contained in our test device, which always recoils rearwardly after the shot is fired. This particular day the explosion took place upon pulling the trigger, but the device did not recoil rearwardly. We allowed the combination to simmer down for two days before opening the lid on the test device, and we found the stock was intact, the gun was of course locked up and welded together, and no damage to any of the parts. Upon close examination by putting drill rod down the barrel we found that none of the 5 slugs had moved. They were wedged in so tightly at this particular combination that this high pressure of 400,000 or 500,000 ppsi was not sufficient to propel the projectiles forward. Now according

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to Newton's Law for every action there is an equal and opposite reaction. Because there was no movement forward of those projectiles the recoil did not take place and therefore, the stock did not disintegrate. General Hatcher at this point emitted a couple oaths and said: "Well, I guess old Newton was right."

Now as to comparison of other rifles. During this test, however, all types of rifles including well known competitive brand were tested and they all fell by the wayside with about one slug in the barrel. This of course was normal and natural as the gun was depending upon the brass cartridge case and not upon its inherent lug ability to hold the mechanism intact. To prove our point we cut off the shroud of a M/721, subjected it to one slug in the barrel with a 3.4 gram load, and immediately blew up the gun, putting it then in the category with the old-fashioned old-designed types. Since that time other concerns have started to copy the M/721-700 action. However, upon close examination you will find that they haven't quite copied all of the right elements.

Here is another point to consider. Which is the safest? To allow a cartridge case to blow up at 70,000-80,000 ppsi, or to retain it up to a point where it will reach 150,000 ppsi and then blow? Well, for me, I would take the one that blows earlier because less damage could be done. However, if I were to design a gun and wanted to go beyond the strength of the cartridge case, I would go all the way, such as we have done in the M/721, and not halfway, as the halfway point is much more dangerous.

I do not want to comment on our competition at this point. All I can say is that they are halfway. Perhaps you can put two and two together and get the correct answer from this statement. However, please don't quote me. The only thing I'm giving you here, Carl, is fact and not fiction.

We here at Remington as I have said before, test our guns more severely than the military and certainly know more, I believe, about testing, and test our guns more stringently than any commercially made rifle or shotgun. Naturally, when new developments are made competitively we test all of these to determine where they stand with respect to strength and function and how they compare with our own. And I can truthfully tell you based upon fact, that our rifles and shotguns are stronger than our competition. For example, I was testing some bolt action shotguns about 6 months ago to establish a strength characteristic in these designs which had been connected with an ammunition problem, as we by the way do not make bolt action shotguns, and I found out some very gratifying things which I can't reveal here as they would involve competitive guns. But believe me, I certainly would not shoot any of these from the shoulder. Just because there is a large bolt handle and an apparently large piece of steel supporting it, does not mean that the gun is strong. And these misconceptions can cause difficulties.

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Going back to my tests with General Hatcher. After he examined the results of our tests he immediately sent to me an M1 rifle, an Enfield, a Japanese Arisaka converted over to a 30-06 and some others that I do not recall. We sent them all back in a box, all in a multitude of broken, scrap, twisted metal. I had no comment from General Hatcher after returning those guns to him as they demonstrated some weaknesses which he probably did not wish to reveal at that time to the general public.

The Model 600 was a good subject for test as it contained the same bolt mechanism as the M/721-700 systems. However, the receiver is much shorter and therefore stiffer. This has nothing to do with the strength of the gun but does have something to do with the supporting of the back of the bolt, keeping it in line with the chamber. In order to test the M/600 we rechambered it to a 30-06 so that we could keep our basis for tests on the same pattern, and subjected it to these high pressure tests such as mentioned in the letter. It, too, withstood all of these extreme high pressures and was, as we say, normal in every respect.

My comment on which cartridge has caused the most problems. The 30-06 will blow up a gun faster than any caliber I know of, as it can be loaded to a much higher degree than any of the others based upon its cartridge case strength and bore diameter. A 270 will not come anywhere near the 30-06 in developing high pressures when the barrel is plugged. The Magnums are another story. Here we have a cartridge case that has been reinforced and therefore does not require the same support around the base of the case that the 30-06 family would require. Therefore higher pressures can be obtained with the belted case with an unsupported, unshrouded gun.

For my money when I am experimenting with handloads, accuracy shooting and a little above normal pressure work, I'll take the M/700 and 600 actions, and the rest of the experimenters can have their so-called strong actions for this work. I have a lot of faith in the combinations of ammunition-primer-powder, etc. but not enough to put my cheek on top of it. I'll take the shrouded support that in turn is also supported by the barrel, and the barrel supported by the receiver. And I think I'll come out way ahead of the game with both eyes, ears and head on my shoulders. At least I would have greater peace of mind.

I hope that I have answered your questions, Carl, and I'll get these items off to you as soon as possible. Please let me hear from you soon. By the way, as far as M/700 actions are concerned, the policy is now that you can obtain those from authorized Remington gunsmiths. If you have any difficulty in obtaining these items from your gunsmiths, please let me know.

Best regards,

Wayne E. Leek

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Illion Research Division

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