Mr. FRAZIER. And they were found to be similar in metallic composition.

Mr. SPECTER. Can you state with any more certainty——

Mr. FRAZIER. Excuse me, one thing. These, as a group, were compared with the bullet fragment, Commission Exhibit 567, which was found on the front seat of the automobile, which also was found to be similar in metallic composition.

Mr. SPECTER. Is it possible to state with any more certainty whether or not any of those fragments came from the same bullet?

Mr. FRAZIER. Not definitely, no; only that they are of similar lead composition.

Mr. SPECTER. Have you now described fully all of the relevant characteristics of the fragments identified as Commission Exhibit 843?

Mr. FRAZIER. Yes, sir.

Mr. SPECTER. Are there any other bullets or bullet fragment or metallic substances of any sort connected with this case in any way which you have examined which you have not already testified to here today or on your prior appearance?

Mr. FRAZIER. No, sir; that is all of them.

Mr. DULLES. Is there anything further?

Mr. SPECTER. No.

Mr. DULLES. Thank you very much, Mr. Frazier.

The Commission will reconvene at 2:30.

(Whereupon, at 1:30 p.m., the President's Commission recessed.)

Afternoon Session

TESTIMONY OF DR. ALFRED G. OLIVIER

The President's Commission reconvened at 3 p.m.

The CHAIRMAN. The Commission will come to order.

Mr. Specter, has the doctor been sworn yet?

Mr. SPECTER. No, sir; he has not.

The CHAIRMAN. Doctor, would you raise your right hand and be sworn, please? Do you solemnly swear the testimony you are about to give in the matter before this Commission will be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. OLIVIER. Yes, sir.

The CHAIRMAN. You may be seated.

Mr. SPECTER. State your full name for the record.

Dr. OLIVIER. Dr. Alfred G. Olivier.

Mr. SPECTER. What is your occupation or profession?

Dr. OLIVIER. A supervisory research veterinarian and I work for the Department of the Army at Edgewood Arsenal, Md.

Mr. SPECTER. Would you describe the nature of your duties at that arsenal, please?

Dr. OLIVIER. Investigating the wound ballistics of various bullets and other military missiles.

Mr. SPECTER. Would you describe the general nature of the tests which are carried on at Edgewood Arsenal?

Dr. OLIVIER. For example, with a bullet we run tissue studies getting the retardation of the bullet through the tissues, the penetration, various characteristics of it. We use as good tissue simulant 20 percent gelatin. This has a drag coefficient of muscle tissue and makes an excellent homogenous medium to study the action of the bullet. We also use animal parts and parts of cadavers where necessary to determine the characteristics of these things.

Mr. SPECTER. Would you set forth your educational background briefly, please?

Dr. OLIVIER. Yes; I did 2 years of preveterinary work at the University of New Hampshire and 4 years of veterinary school at the University of Pennsylvania, and I hold a degree doctor of veterinary medicine at the University of Pennsylvania.

Mr. SPECTER. In what year did you complete your educational work?

Dr. OLIVIER. 1953.

Mr. SPECTER. Would you outline your experience in the field subsequent to 1953?

Dr. OLIVIER. In this field?

Mr. SPECTER. Yes, sir.

Dr. OLIVIER. I came to Edgewood Arsenal, then the Army Chemical Center, in 1957, and originally to work, take charge of the animal colonies but immediately I got interested in the research and started working in the field of wound ballistics and have been in it ever since, and am presently Chief of the Wound Ballistics Branch.

Mr. SPECTER. Have you been in charge of a series of tests performed to determine certain wound ballistics on circumstances analogous to the underlying facts on wounds inflicted upon President Kennedy and Governor Connally on November 22, 1963?

Dr. OLIVIER. Yes; I have.

Mr. SPECTER. And in the course of those tests what weapon was used?

Dr. OLIVIER. It was identified as Commission Exhibit 139. It was a 6.5 mm. Mannlicher-Carcano rifle.

Mr. SPECTER. Did the designation, Commission Exhibit No. 139, appear on the body of that rifle?

Dr. OLIVIER. Yes; it did.

Mr. SPECTER. What type of bullets were used in the tests which you performed?

Dr. OLIVIER. We used the Western ammunition, Western being a division of Olin Industries, Winchester Western, it was lot 6,000 to 6.5 mm. round. Has a muzzle velocity of approximately 2,160 feet per second.

Mr. SPECTER. And were those bullets obtained by you upon information provided to you by the Commission's staff as to the identity of the bullets which were believed to have been used during the assassination?

Dr. OLIVIER. Yes; I first got the identity from the people at Aberdeen Proving Grounds and then I further checked with the Commission to see if that was right before ordering this type of ammunition.

Mr. SPECTER. And where were those bullets obtained from?

Dr. OLIVIER. I obtained 100 rounds from Remington at Bridgeport, Conn., and Dr. Dziemian obtained another 160 rounds, I believe, from Winchester in New Haven.

Mr. SPECTER. Did you perform certain tests to determine the wound ballistics and include in that the penetration power of the Mannlicher-Carcano rifle, which you referred to, firing the Western Cartridge Co. bullet by comparison with other types of bullets?

Dr. OLIVIER. We didn't fire any of the others at the same time. These had been fired previously. We have all these records for comparison.

Mr. SPECTER. Was the Mannlicher-Carcano rifle then fired for comparison purposes with the other bullets where you already had your experience?

Dr. OLIVIER. No; it was fired for the purposes for which—to try to shed some light on say the factors leading to the assassination and all, not for comparison with the other bullets.

Mr. SPECTER. I now show you a photograph which is marked as Commission Exhibit No. 844, may it please the Commission, and ask you if this photograph was prepared by you in conjunction with the study on the Mannlicher-Carcano and the Western Cartridge Co. bullet?

Dr. OLIVIER. Yes; it was.

Mr. SPECTER. Would you explain to the Commission what that photograph depicts?

Dr. OLIVIER. Actually, the bullet passed through two gelatin blocks. This was done as part of an energy study to see the amount of energy imparted to the block of gelatin taking a high-speed motion picture. These blocks show a record of the permanent cavity left in the gelatin. This is not necessarily the total penetration. This bullet when it comes out of the second block still has quite a bit of penetrating power. Quite a few of these bullets would go into a dirt bank and imbed themselves so deeply that they couldn't be recovered.

Mr. SPECTER. I now show you Commission Exhibit No. 845 which is a photograph, and ask you to state for the record what that photograph represents?

Dr. OLIVIER. This has been adopted as standard military ammunition of the U.S. Army. It is known as the NATO round. It is M–80 ball fired in the M–14 rifle. It has a different—it is a full jacketed military bullet but has a different point, what they call a no jag point, a sharp point. It has tumbling characteristics. When it goes in a certain block it tumbles and does the same in the body. It is more efficient in producing wounds than the bullet under study.

Mr. SPECTER. How do the impact, penetration, and other characteristics of the bullet depicted in 845 compare with the Western Cartridge Co. bullet fired from the Mannlicher-Carcano in 844?

Dr. OLIVIER. It has better wounding potential due to the quicker tumbling but it would not have as good penetrating ability, when it starts tumbling and releasing all that energy doing all that damage it comes to a stop in a shorter distance.

Mr. SPECTER. Would the Western bullet be characterized as having the qualities of a more stable bullet?

Dr. OLIVIER. Yes; it would. You mean in the target?

Mr. SPECTER. Yes, sir.

Dr. OLIVIER. Yes.

Mr. SPECTER. The stability in the air would be the same for any missile, would it not?

Dr. OLIVIER. To be a good bullet they should be stable in air in order to hit what you are aiming at, yes.

Mr. SPECTER. Then would the characteristics of stability in the air be the same for either of the two bullets you have heretofore referred to?

Dr. OLIVIER. Essentially so.

Mr. SPECTER. I now hand you photograph marked as Commission Exhibit No. 846 and ask you to state what that depicts?

Dr. OLIVIER. This is a 257 Winchester Roberts soft nose hunting bullet. This one pictured fired from right to left instead of left to right and the bullet didn't even go out of the block. It deforms almost immediately on entering the block and releases its energy rather rapidly. This type of ammunition is illegal for military use. We are just studying the wounding characteristics of various bullets, but this is not a military bullet.

Mr. SPECTER. How does it compare with the Western bullet?

Dr. OLIVIER. It would be better for wounding, better for hunting purposes. But as I said, it isn't acceptable as a military bullet.

Mr. SPECTER. How does it compare with respect to penetration power?

Dr. OLIVIER. Much less than the Mannlicher-Carcano.

Mr. SPECTER. In the normal course of the work that you perform for the U.S. Army at Edgewood Arsenal, do you have occasion to simulate substances for testing purposes on determining the path of a bullet through the human body?

Dr. OLIVIER. Yes; we do use animal tissues or gelatin as simulants for tissues of the human body.

Mr. SPECTER. Has the autopsy report on President John F. Kennedy been made available to you for your review?

Dr. OLIVIER. Yes; it has.

Mr. SPECTER. And subsequent to your review of that report, did you make an effort to simulate the body tissue through which the bullet is reported to have passed through the President in accordance with the report of the autopsy surgeon; entering on the rear of his neck, 14 cm. below the mastoid process and 14 cm. to the left of the right acromion process, passing through a fascia channel, striking the trachea and exiting through the lower anterior of the neck?

Dr. OLIVIER. Yes; I did.

Mr. SPECTER. What substance did you prepare to simulate that portion of the President's body?

Dr. OLIVIER. We determined the distance on various people by locating this anatomical region and using people of various sizes we found that regardless of general body build, the distance penetrated was around 13½ to 14½ cm.

As a consequence, I used gelatin blocks 20 percent gelatin cut at 13½ cm.

lengths and also used horsemeat and goatmeat placed in a box so that—this was a little harder to get the exact length but that varied between 13½ and 14½ cm. of muscle tissue.

Mr. SPECTER. Did that simulate, then, the portion of the President's body through which the bullet is reported to have passed, as closely as you could for your testing purposes?

Dr. OLIVIER. As closely as we could for these test purposes; yes.

Mr. SPECTER. I now hand you a photograph marked as Commission Exhibit No. 847 and ask you to testify as to what that depicts?

Dr. OLIVIER. This is a box containing—I couldn't say looking at it whether it is the horsemeat or the goatmeat but one of the two. The distance traveled through that meat would be 13½ to 14½ centimeters. It is also covered with clothing and clipped goatskin on the entrance and exit sides, and behind that are the screens for measuring the exit velocity. We had already determined the striking velocity by firing I believe it was—I have it right here if you want——

Mr. SPECTER. Before you proceed to that, describe the type of screens which are shown in the picture which were used to measure exit velocity, if you please?

Dr. OLIVIER. Yes. These screens are known as the break-type screen. They are silver imprinted on paper and when the bullet passes through it breaks the current. When it passes through the first screen it breaks the current activating a chronograph, counting chronograph. When it passes through the second screen it stops. This is over a known distance, and so the time that it took to pass between the first and the second will give you the average velocity halfway between the two screens.

Mr. SPECTER. I now hand you a photograph marked Commission Exhibit 848 and ask you to describe what that shows?

Dr. OLIVIER. This was a similar setup used for firing through gelatin. It had clothing and skin over the entrance side only. If it had been placed on the other side it would have just flown off.

Mr. SPECTER. And that is similar to that depicted in 846?

Dr. OLIVIER. Essentially; yes.

Mr. SPECTER. Except that it is——

Dr. OLIVIER. Gelatin instead of the tissues.

Mr. SPECTER. Now at what range was the firing performed on the gelatin, goatmeat and horsemeat?

Dr. OLIVIER. This firing was done at a 60-yard range.

Mr. SPECTER. And what gun was used?

Dr. OLIVIER. The 6.5 Mannlicher-Carcano that was marked Commission Exhibit 139.

Mr. SPECTER. And what bullets were used?

Dr. OLIVIER. The Western ammunition lot 6,000, 6.5 Mannlicher-Carcano.

Mr. SPECTER. And was there any substance placed over the gelatin, horsemeat and goatmeat?

Dr. OLIVIER. Yes; over the gelatin we had clothing; had a suit, shirt and undershirt, and underneath that a clipped goatskin. The same thing was over the meat, and on the other side of the meat was also clipped goatskin.

Mr. SPECTER. Would there be any significant difference to the test by leaving out the undershirt if the President had not worn an undershirt?

Dr. OLIVIER. No.

Mr. SPECTER. So that the circumstance was simulated with the actual type clothing and a protective skin over the substance just as realistically as you could make it?

Dr. OLIVIER. Yes.

Mr. SPECTER. What measurement was obtained as to the entrance velocity of the bullet at the distance of 60 yards which you described?

Dr. OLIVIER. The striking velocity at an average of three shots was 1,904 feet per second.

Mr. SPECTER. And what was the average exit velocity on each of the substances used?

Dr. OLIVIER. For the gelatin the average exit velocity was 1,779 feet per

second. The horsemeat, the average exit velocity was 1,798 feet per second. And the goatmeat the average exit velocity was 1,772 feet per second.

Mr. SPECTER. I now hand you a photograph marked Commission Exhibit 849 and ask you what that picture represents?

Dr. OLIVIER. This is one of the gelatin blocks used in that test. It shows the type of track left by the bullet passing through it. That bullet is very stable. Passing through the body and muscle, it would make a similar type wound. Of course, you couldn't observe it that nicely.

Mr. SPECTER. Would you describe that as being a straight line?

Dr. OLIVIER. Yes.

Mr. SPECTER. I now hand you a picture marked Commission Exhibit No. 850 and ask you what that represents?

Dr. OLIVIER. These are pieces of clipped goatskin, clipped very shortly. There is still some hair on it. These were placed, these particular ones were placed over the tissues. This would be placed over the entrance side of the animal.

Mr. SPECTER. When you say "this," you are referring to a piece of goatskin which is marked "enter"?

Dr. OLIVIER. Marked "enter." The one marked "exit" was placed on the far side of the tissues and the bullet passed through that after it came out of the tissues.

Mr. SPECTER. For the record, will you describe the characteristics, which are shown on the goatskin at the point of entry, please?

Dr. OLIVIER. At the point of entry the wound holes through the skin are for all purposes round. On the exit side they are more elongated, two of them in particular are a little more elongated. The bullet had started to become slightly unstable coming out.

Mr. SPECTER. And how about the third or lower bullet on the skin designated exit?

Dr. OLIVIER. That hole appears as more stable than the other two. In all three cases the bullet is still pretty stable. The gelatin blocks, there were gelatin blocks placed behind these things too, and for all practical purposes, the tracks through them still indicated a stable bullet.

Mr. SPECTER. Are there any other conclusions which you would care to add to those which you have already indicated, resulting from the tests you have heretofore described?

Dr. OLIVIER. Well, it means that the bullet that passed through the President's neck had lost very little of its wounding potential and was capable of doing a great deal of damage in penetrating. I might mention one thing showing how great its penetrating ability was. That say on one of the gelatin shots, it went through a total, counting the gelatin block, it went through plus the backing up blocks of gelatin, it went through a total of 72½ centimeters of gelatin, was still traveling and buried itself in a mound of earth so it has terrific penetrating ability. This means that had the bullet that passed through the President's neck hit in the car or anywhere you would have seen evidence, a good deal of evidence.

Mr. SPECTER. Dr. Olivier, in the regular course of your work for the U.S. Army, do you have occasion to perform tests on animal materials where the characteristics of those animals materials are sufficiently similar to human bodies to make a determination of the effect of the bullet wounds in human bodies?

Dr. OLIVIER. Yes; I do.

Mr. SPECTER. And did you have occasion to make a test on goat material in connection with the experiments which you ran?

Dr. OLIVIER. Yes.

Mr. SPECTER. Are you familiar with the wounds inflicted on Governor Connally on November 22, 1963?

Dr. OLIVIER. Yes; from reading the surgeon's report and also from talking to Dr. Gregory and Dr. Shaw.

Mr. SPECTER. Did you have access to the medical reports of Parkland Hospital concerning the wounds of Governor Connally in all respects?

Dr. OLIVIER. Yes.

Mr. SPECTER. And did you have occasion to discuss those wounds in great

detail with Dr. Shaw and Dr. Gregory when they were present in Washington, D.C. on April 21, 1964, preparatory to their testifying before this Commission?

Dr. OLIVIER. Yes; I did.

Mr. SPECTER. What was the nature of the wound on Governor Connally's back?

Dr. OLIVIER. The surgeon's report described it as about 3 centimeters long, its longest dimension, and it is hard for me to remember reading it or discussing it with him but I did both. Apparently it was a jagged wound. He said a wound like this consists of two things, usually a defect in the epidermis and a central hole which is small, and he could put his finger in it so it was a fairly large wound.

Mr. SPECTER. What was the path of the bullet in a general way, based on the information provided to you concerning Governor Connally's wound in the back?

Dr. OLIVIER. Apparently it passed along the rib. I don't recall which rib it was but passed the fifth rib, passed along this rib causing a fracture that I believe removed about 10 centimeters of the rib through fragments through the pleura, lacerating the lung. I asked Dr. Shaw directly whether he thought the bullet had gone through the pleural cavity and he said he didn't believe that it had, that the damage was done by the rib fragments. Then the bullet exited as described somewhat below the right nipple.

Mr. SPECTER. Did you perform a test on goat substance to endeavor to measure the reduction in velocity of a missile similar to the one which passed through Governor Connally?

Dr. OLIVIER. Yes; I did.

Mr. SPECTER. Why was goat substance selected for that purpose in the testing procedure?

Dr. OLIVIER. We usually use this in our work so we are familiar with it. I am not saying it is the only substance that could be used, but we were not using any unknown procedures or any procedures that we hadn't used already.

Mr. SPECTER. Does it closely simulate the nature of a wound in the human body?

Dr. OLIVIER. In this particular instance it did.

Mr. SPECTER. Was the wound inflicted on the goat, then, subjected to X-ray analysis for the purpose of determining the precise nature of the wound and for comparison purposes with that wound——

Dr. OLIVIER. Yes; it was.

Mr. SPECTER. Inflicted on Connally?

Dr. OLIVIER. Yes; it was.

Mr. SPECTER. I now hand you an X-ray marked Commission Exhibit 851 and ask you to state what that shows?

Dr. OLIVIER. It shows a fractured rib. From this you wouldn't be able to—well, if you were a better radiologist than I was, you might be able to tell which one, but it was the eighth left rib. It shows a comminuted fracture extending some distance along the rib.

Mr. SPECTER. I now hand you Commission Exhibit No. 852, which is a photograph, and ask you to testify as to what that depicts, please?

Dr. OLIVIER. This is a photograph taken from the same X-ray again showing the comminuted fracture of the eighth left rib.

Mr. SPECTER. And is that a photograph then of the X-ray designated Commission Exhibit 851?

Dr. OLIVIER. Yes; it is.

Mr. SPECTER. Did you have an opportunity to observe personally the X-rays showing the wound on Governor Connally's rib?

Dr. OLIVIER. Yes; I did.

Mr. SPECTER. And how do those X-rays compare with the wound inflicted as depicted in Exhibits 851 and 852?

Dr. OLIVIER. They are very similar.

Mr. SPECTER. When the wounds were inflicted, as depicted in 851 and 852, what weapon was used?

Dr. OLIVIER. This was again the 6.5 millimeter Mannlicher-Carcano rifle.

Mr. SPECTER. And what bullets were used?

Dr. OLIVIER. The 6.5 millimeter Western ammunition lot 6,000.

Mr. SPECTER. And what distance was utilized?

Dr. OLIVIER. On the goat the distance was 70 yards.

Mr. SPECTER. And was there any covering over the goat?

Dr. OLIVIER. Yes. There was a suit, shirt, and undershirt.

Mr. SPECTER. What was the entrance velocity of the bullet?

Dr. OLIVIER. Striking velocity for an average of 11 shots was 1,929 feet per second.

Mr. SPECTER. And what was the exit velocity?

Dr. OLIVIER. The exit velocity was 1,664 feet per second.

Mr. SPECTER. I now hand you a box containing a bullet, which has been marked as Commission Exhibit No. 853, and ask you if you have ever seen that bullet before?

Dr. OLIVIER. Yes; I have.

Mr. SPECTER. And under what circumstances have you previously seen that bullet?

Dr. OLIVIER. This was the bullet that was fired through the goat. It went through the velocity screens into some cotton waste, dropped out of the bottom of that and was lying on the floor. It was picked up immediately afterwards still warm, so we knew it was the bullet that had fired that particular shot.

Mr. SPECTER. Was that fired through the goat depicted in the photographs and X-ray, 851 and 852?

Dr. OLIVIER. Yes; that was the goat.

Mr. SPECTER. Would you describe for the record, verbally please, the characteristics of that bullet?

Dr. OLIVIER. The bullet has been quite flattened. The lead core is extruding somewhat from the rear. We weighed the bullet. It weighs 158.8 grains.

Mr. SPECTER. I now hand you Commission Exhibit 399, which has been heretofore in Commission proceedings identified as the bullet found on the stretcher of Governor Connally, and ask if you have had an opportunity to compare 399 with 853?

Dr. OLIVIER. Yes; I have.

Mr. SPECTER. And what did you find on that comparison?

Dr. OLIVIER. The bullet recovered on the stretcher has not been flattened as much, but there is a suggestion of flattening there from a somewhat similar occurrence. Also, the lead core has extruded from the rear in the same fashion, and it appears that some of it has even broken from the rear.

Mr. SPECTER. Is there some flattening on both of those bullets in approximately the same areas toward the rear of the missiles?

Dr. OLIVIER. In the bullet, our particular bullet is flattened the whole length, but you say towards the rear?

Mr. SPECTER. You say our bullet; you mean 853?

Dr. OLIVIER. Yes, 853 is flattened. No. 399 is flattened more towards the rear.

Mr. SPECTER. Are there any other conclusions which you have to add to the tests performed on the goat?

Dr. OLIVIER. Well, again in this test it demonstrates that the bullet that was stable when it struck in this fashion again lost very little velocity in going through that much goat tissue.

Incidentally, the amount of goat tissue it traversed was probably somewhat less than the Governor, but in any case it indicates the bullet would have had a lot of remaining velocity and could have done a lot of damage.

Another thing that hasn't been brought up is the velocity screen immediately behind the goat, the imprint of the bullet left on it was almost the length of the bullet.

Mr. SPECTER. What does that indicate?

Dr. OLIVIER. This indicates that the bullet was now no longer traveling straight but either traveling sideways or tumbling end over end at the time it hit the screen.

Mr. SPECTER. And that was after the point of exit from the goat?

Dr. OLIVIER. Yes.

Mr. SPECTER. Are there any other conclusions which you found from the studies on the goat?

Dr. OLIVIER. No, I believe that is all I can think of right at this moment.

Mr. SPECTER. In the regular course of your work for the U.S. Army, do you have occasion to perform tests on parts of human cadavers to determine the effects of bullets on human beings?

Dr. OLIVIER. Yes, I do.

Mr. SPECTER. And was a series of tests performed under your supervision on the portions of human cadavers simulated to the wound inflicted on the wrist of Governor Connally?

Dr. OLIVIER. Yes.

Mr. SPECTER. Were you familiar with the nature of the wound on Governor Connally's wrist prior to performing those tests?

Dr. OLIVIER. Yes, I was.

Mr. SPECTER. What was the source of your information on those wounds?

Dr. OLIVIER. I had read the surgeon's report, also talked with Dr. Gregory, the surgeon who had done the surgery, and had looked at the X-rays.

Mr. SPECTER. Had you had an opportunity to discuss the wounds with Dr. Gregory and view the X-rays taken at Parkland Hospital, here in the Commission headquarters?

Dr. OLIVIER. Yes; I did.

Mr. SPECTER. On April 21, 1964?

Dr. OLIVIER. Yes.

Mr. SPECTER. I now hand you an X-ray marked as Commission Exhibit 854, and ask you what that depicts?

Dr. OLIVIER. This is a comminuted fracture of the distal end of the radius of a human arm.

Mr. SPECTER. And in what manner was that wound caused?

Dr. OLIVIER. It was caused by a bullet from the Commission Exhibit 139. This was again the 6.5-millimeter Mannlicher-Carcano Western ammunition lot 6,000.

Mr. SPECTER. Fired at what distance?

Dr. OLIVIER. Fired at a distance of 70 yards.

Mr. SPECTER. And was there anything protecting the wrist at the time of impact?

Dr. OLIVIER. Not protection but there was again clothing, this time suit material or suit lining, at least suit material and shirt. I am not sure about the lining. I can tell you. I have it right here. Suit material, suit lining material, and shirt material.

Mr. SPECTER. I now hand you a photograph marked as Commission Exhibit 855 and ask you what that represents?

Dr. OLIVIER. This is a photograph taken from the X-ray, Commission Exhibit 854.

Mr. SPECTER. Will you describe for the record the details of the injuries shown on 854 and 855, please?

Dr. OLIVIER. This is a comminuted fracture of the distal end of the radius. It was struck directly by the bullet. It passed through, not directly through but through at an oblique angle so that it entered more proximal on the dorsal side of the wrist and distal on the volar aspect.

Mr. SPECTER. How does the entry and exit compare with the wound on Governor Connally which you observed on the X-rays?

Dr. OLIVIER. In this particular instance to the best of my memory from looking at the X-rays, it is very close. It is about one of the best ones that we obtained.

Mr. SPECTER. Is there any definable difference at all?

Dr. OLIVIER. I couldn't determine any.

Mr. SPECTER. It is close, you say?

Dr. OLIVIER. Yes. If I had both X-rays in front of me if there was a difference I could determine it, but from memory I would say it was for all purposes *identical.*

Mr. SPECTER. I now hand you a bullet in a case marked Commission Exhibit 856 and ask if you have ever seen that before?

Dr. OLIVIER. Yes. This is the bullet that caused the damage shown in Commission Exhibits Nos. 854 and 855.

Mr. SPECTER. Would you describe that bullet for the record, please?

Dr. OLIVIER. The nose of the bullet is quite flattened from striking the radius.

Mr. SPECTER. How does it compare, for example, with Commission Exhibit 399?

Dr. OLIVIER. It is not like it at all. I mean, Commission Exhibit 399 is not flattened on the end. This one is very severely flattened on the end.

Mr. SPECTER. What was the velocity of the missile at the time it struck the wrist depicted in 854 and 855?

Dr. OLIVIER. The average striking velocity was 1,858 feet per second.

Mr. SPECTER. Do you have the precise striking velocity of that one?

Dr. OLIVIER. No; I don't. We could not put velocity screen in front of the individual shots because it would have interfered with the gunner's view. So we took five shots and got an average striking velocity.

Mr. SPECTER. When you say five shots with an average striking velocity, those were at the delineated distance without striking anything on those particular shots?

Dr. OLIVIER. Right, and after establishing that velocity, then we went on to shoot the various arms.

Mr. SPECTER. And what was the exit velocity?

Dr. OLIVIER. On this particular one?

Mr. SPECTER. If you have it?

Dr. OLIVIER. Yes. Well, I don't know if I have that or not. We didn't get them in all because some of these things deflect. No, I have no exit velocity on this particular one.

Mr. SPECTER. What exit velocity did you get on the average?

Dr. OLIVIER. Average exit velocity was 1,776 feet per second. This was for an average of seven. We did 10. We obtained velocity on seven.

Mr. SPECTER. Would the average reduction be approximately the same, in your professional opinion, as to the bullet exiting from the wrist depicted in 854 and 855?

Dr. OLIVIER. Somewhat. Let me give you the extremes of our velocities. The highest one was 1,866 and the lowest was 1,664, so there was a 202-feet-per-second difference in the thing. Some of the cases bone was missed, in other cases glancing blows. But I would say it is a close approximation to what the exit velocity was on that particular one.

Mr. SPECTER. And what would the close approximation be, the average?

Dr. OLIVIER. The average.

Mr. SPECTER. Would you compare the damage, which was done to Governor Connally's wrist, as contrasted with the damage to the wrist depicted in 854 and 855?

Dr. OLIVIER. The damage in the wrist that you see in the X-ray on 854 and 855, the damage is greater than was done to the Governor's wrist. There is more severe comminution here.

Mr. SPECTER. How much more severe is the comminution?

Dr. OLIVIER. Considerably more. If I remember correctly in the X-rays of the Governor's wrist, I think there were only two or three fragments, if that many. Here we have many, many small fragments.

Mr. SPECTER. In your opinion, based on the tests which you have performed, was the damage inflicted on Governor Connally's wrist caused by a pristine bullet, a bullet fired from the Mannlicher-Carcano rifle 6.5 missile which did not hit anything before it struck the Governor's wrist?

Dr. OLIVIER. I don't believe so. I don't believe his wrist was struck by a pristine bullet.

Mr. SPECTER. What is the reason for your conclusion on that?

Dr. OLIVIER. In this case I go by the size of the entrance wound and exit wound on the Governor's wrist. The entrance wound was on the dorsal surface, it was described by the surgeon as being much larger than the exit wound. He said he almost overlooked that on the volar aspect of the wrist.

In every instance we had a larger exit wound than an entrance wound firing

with a pristine bullet apparently at the same angle at which it entered and exited the Governor's wrist.

Also, and I don't believe they were mixed up on which was entrance and exit. For one thing the clothing, you know, the surgeon found pieces of clothing and the other thing the human anatomy is such that I don't believe it would enter through the volar aspect and out the top.

So I am pretty sure that the Governor's wrist was not hit by a pristine or a stable bullet.

Mr. SPECTER. What is there, in and of the nature of the smaller wound of exit and larger wound of entrance in the Governor's wrist as contrasted with a smaller wound of entrance and larger wound of exit in 854 and 855, which leads you to conclude that the Governor's wrist was not struck by a pristine bullet?

Dr. OLIVIER. Do you want to repeat that question again?

Mr. SPECTER. What is there about the wound of entry or exit which led you to think that the Governor's wrist wasn't struck by a pristine bullet?

Dr. OLIVIER. Well, he would have had a larger exit wound than entrance wound, which he did not.

Mr. SPECTER. And if the velocity of the missile is decreased, how does that effect the nature of the wounds of entry and exit?

Dr. OLIVIER. If the velocity is decreased, if the bullet is still stable, he still should have a larger exit wound than an entrance.

Now, on the other hand, to get a larger entrance wound and a smaller exit wound, this indicates the bullet probably hit with very much of a yaw. I mean, as this hole appeared in the velocity screen the bullet either tumbling or striking sideways, this would have made a larger entrance wound, lose considerable of its velocity in fracturing the bone, and coming out at a very low velocity, made a smaller hole.

Mr. SPECTER. So the crucial factor would be the analysis that the bullet was characterized with yaw at the time it struck?

Dr. OLIVIER. Yes.

Mr. SPECTER. Causing a larger wound of entry and a smaller wound of exit?

Dr. OLIVIER. Yes.

Mr. SPECTER. Now is there anything in the——

Dr. OLIVIER. Also at a reduced velocity because if it struck at considerable yaw at a high velocity as it could do if it hit something and deflected, it would have, it could make a larger wound of exit but it would have been even a more severe wound than we had here. It would have been very severe, could even amputate the wrist hitting at high velocity sideways. We have to say this bullet was characterized by an extreme amount of yaw and reduced velocity. How much reduced, I don't know, but considerably reduced.

Mr. SPECTER. Does the greater damage, inflicted on the wrist in 854 and 855 than that which was inflicted on Governor Connally's wrist, have any value as indicating whether Governor Connally's wrist was struck by a pristine bullet?

Dr. OLIVIER. No; because holding the velocity the same or similar the damage would be greater with a tumbling bullet than a pristine.

I think it reflects both instability and reduced velocity. You have to show the two. I mean, the size of the entrance and exit are very important. This shows that the thing was used when it struck. The fact that there was no more damage than was done by a tumbling bullet indicates the bullet at a reduced velocity. You have to put these two things together.

Mr. SPECTER. Had Governor Connally's wrist been struck with a pristine bullet without yaw, would more damage have been inflicted——

Dr. OLIVIER. Yes.

Mr. SPECTER. Than was inflicted on the Governor's wrist?

Dr. OLIVIER. Yes.

Mr. SPECTER. So then the lesser damage on the Governor's wrist in and of itself indicates in your opinion——

Dr. OLIVIER. That it wasn't struck by a pristine bullet; yes.

Mr. SPECTER. Are there any other conclusions which flow from the experiments which you conducted on the wrist?

Dr. OLIVIER. We concluded that it wasn't struck by a pristine bullet. Also drew the conclusion that it was struck by an unstable bullet, a bullet at a much

reduced velocity. The question that it brings up in my mind is if the same bullet that struck the wrist had passed through the Governor's chest, if the bullet that struck the Governor's chest had not hit anything else would it have been reduced low enough to do this, and I wonder, based on our work—it brings to mind the possibility the same bullet that struck the President striking the Governor would account for this more readily. I don't know, I don't think you can ever say this, but it is a very good possibility, I think more possible, more probable than not.

The CHAIRMAN. What is more probable than not, Doctor?

Dr. OLIVIER. In my mind at least, and I don't know the angles at which the things went or anything, it seems to me more probable that the bullet that hit the Governor's chest had already been slowed down somewhat, in order to lose enough velocity to strike his wrist and do no more damage than it did. I don't know how you would ever determine it exactly. I think the best approach is to find out the angles of flight, whether it is possible. But I have a feeling that it might have been.

The CHAIRMAN. It might have been?

Dr. OLIVIER. Yes.

The CHAIRMAN. The one that went through his chest went through his hand also.

Dr. OLIVIER. Yes; and also through the President.

The CHAIRMAN. The first shot?

Dr. OLIVIER. Well, I don't know whether the first or second. The first one could have missed. It could have been the second that hit both.

The CHAIRMAN. The one that went through his back and came out his trachea?

Dr. OLIVIER. It could have hit the Governor in the chest and went through because it had so little velocity after coming out of the wrist that it barely penetrated the thigh.

The CHAIRMAN. May I ask one more question? Would you think, that the same bullet could have done all three of those things?

Dr. OLIVIER. That same bullet was capable.

The CHAIRMAN. Gone through the President's back as it did, gone through Governor Connally's chest as it did, and then through his hand as it did?

Dr. OLIVIER. It was certainly capable of doing all that.

The CHAIRMAN. It was capable?

Dr. OLIVIER. Yes.

The CHAIRMAN. The one shot?

Dr. OLIVIER. Yes.

Mr. SPECTER. Doctor Olivier, based on the descriptions of the wound on the Governor's back, what in your opinion was the characteristic of the bullet at the time it struck the Governor's back with respect to the course of its flight?

Dr. OLIVIER. Let's say from the size of the wound as described by the surgeon, it could have been tipped somewhat when it struck because that is a fairly large wound. Another thing that could have done it is the angle at which it hit. On the goat some of the wounds were larger than others. On the goat material some of the wounds were larger than others because of the angle at which it hit this material. The same thing could happen on the Governor's back.

Mr. SPECTER. And how was that wound described with respect to its size?

Dr. OLIVIER. The Governor's wound?

Mr. SPECTER. On the Governor's back?

Dr. OLIVIER. About 3 centimeters at its largest dimension.

Mr. SPECTER. And would you have any view as to which factor was more probable, as to whether it was a tangential strike on the Governor's back, or whether there was yaw in the bullet at the time it struck the Governor's back?

Dr. OLIVIER. I couldn't as far as being tangential. I couldn't answer that, not knowing the position of the Governor. But it could have been caused by a bullet yawing. I mean it would have made a larger wound, as that was.

Mr. SPECTER. Is there any other cause which could account for that type of a large wound on the Governer's back other than with the bullet yawing?

Dr. OLIVIER. With this particular bullet those would be the two probable causes of this wound of this size.

Mr. SPECTER. And those two probable causes are what?

Dr. OLIVIER. One, the bullet hitting not perpendicular to the surface of the Governor, in other words, hitting tangential at a slight angle on his back so that it came in cutting the skin. Another, the bullet hitting that wasn't perpendicular to the surface as it hit. The bullet did go along, the surgeon described the path as tangential but he is speaking of along the rib. It isn't clear it was, as it struck, whether it was a tangential shot or actually perpendicular to the Governor's back.

Mr. SPECTER. Permit me to add one additional factor which Dr. Shaw testified to during the course of the proceeding after he measured the angle of decline through the Governor; and Dr. Shaw testified that there was a 25° to 27° angle of declination measuring from front to back on the Governor, taking into account the position of the wound on the Governor's back and the position of the wound on the Governor's chest below the right nipple.

Now with that factor, added to those which you already know, would that enable you to form a conclusion as to whether the nature of the wound on the Governor's back was caused by yaw of the bullet or by a tangential strike?

Dr. OLIVIER. I don't think I would want to say. If I could have seen the Governor's wound, this would have been a help.

Mr. SPECTER. Would the damage done to the Governor's wrist indicate that a bullet which was fired approximately 160 to 250 feet away with the muzzle velocity of approximately 2,000 feet per second, would it indicate that the bullet was slowed up only by the passage through the Governor's body, in the way which you know, or would it indicate that there was some other factor which slowed up the bullet in addition?

Dr. OLIVIER. It would indicate there was some other factor that had slowed up the bullet in addition.

Mr. SPECTER. What is your reason for that conclusion, sir?

Dr. OLIVIER. The amount of damage alone; striking that end it would have caused more severe comminution as we found. You know—if it hadn't been slowed up in some other fashion. At that range it still had a striking velocity of 1,858 or in the vicinity of 1,800 feet per second, which is capable of doing more damage than was done to the Governor's wrist.

Mr. SPECTER. Had the same bullet which passed through the President, in the way heretofore described for the record, then struck the Governor as well, what effect would there have been in reducing its velocity as a result of that course?

Dr. OLIVIER. You say the bullet first struck the President. In coming out of the President's body it would have had a tendency to be slightly unstable. In striking the Governor it would have lost more velocity in his chest than if it had been a pristine bullet striking the Governor's chest, so it would have exited from the Governor's chest I would say at a considerably reduced velocity, probably with a good amount of yaw or tumbling, and this would account for the type of wound that the Governor did have in his wrist.

Mr. SPECTER. The approximate reduction in velocity on passage through the goat was what, Doctor?

Dr. OLIVIER. The average velocity loss in the seven cases we did was 82 feet per second.

Mr. SPECTER. If the bullet had passed through the President prior to the time it passed through the Governor, would you expect a larger loss than 82 feet per second resulting from the passage through the body of the Governor?

Dr. OLIVIER. I am not sure if I heard you correctly. This is if it hit the Governor without hitting the President or hitting the President first?

Mr. SPECTER. Let me rephrase it for you, Dr. Olivier.

Dr. OLIVIER. Yes; please.

Mr. SPECTER. You testified that the bullet lost 82 feet per second when it passed through the goat.

Dr. OLIVIER. Yes.

Mr. SPECTER. Now what would your expectations be as to the reduction in velocity on a bullet which passed through the Governor, assuming that it struck nothing first?

Dr. OLIVIER. It would be greater; the distance through the Governor's chest would have been greater.

Mr. SPECTER. Would that be an appreciable or approximately the same?

Dr. OLIVIER. Can I bring in any other figures? Dr. Dziemian has computed approximately what he thought it would have lost.

Mr. SPECTER. Yes, of course, if you have any other figure which would be helpful.

Dr. DZIEMIAN. I believe you misunderstood Mr. Specter. I think you gave the figure for the loss of velocity through the Governor's wrist instead of through his chest.

Dr. OLIVIER. I am sorry. We were on the wrist; okay.

Mr. SPECTER. Let me start again then. In an effort to draw some conclusion about the reduction in velocity through the Governor's chest, I am now going back and asking you what was the reduction in velocity of the bullet which passed through the goat?

Dr. OLIVIER. Yes; I did misunderstand you. I am sorry. The loss in velocity passing through the goat was 265 feet per second.

Mr. SPECTER. Now, would that be the approximate loss in velocity of a pristine bullet passing through the Governor?

Dr. OLIVIER. The loss would be somewhat greater.

Mr. SPECTER. How much greater in your opinion?

Dr. OLIVIER. Do you have that figure, Dr. Dziemian?

Dr. DZIEMIAN. I would say a pristine bullet of the Governor was about half again thicker. It would be about half again as great velocity, somewhere around 400.

Mr. SPECTER. Had the bullet passed through only the Governor, losing velocity of 400 feet per second, would you have expected that the damage inflicted on the Governor's wrist would have been about the same as that inflicted on Governor Connally or greater?

Dr. OLIVIER. My feeling is it would have been greater.

Mr. SPECTER. Had the bullet passed through the President and then struck Governor Connally, would it have lost velocity of 400 feet per second in passing through Governor Connally or more?

Dr. OLIVIER. It would have lost more.

Mr. SPECTER. What is the reason for that?

Dr. OLIVIER. The bullet after passing through, say a dense medium, then through air and then through another dense medium tends to be more unstable, based on our past work. It appears to be that it would have tumbled more readily and lost energy more rapidly. How much velocity it would have lost, I couldn't say, but it would have lost more.

Mr. SPECTER. Are there any indications from the internal wounds on Governor Connally as to whether or not the bullet which entered his body was an unstable bullet?

Dr. OLIVIER. The only thing that might give you an indication would be the skin wound of entrance, the type of rib fracture and all that I think could be accounted for by either type, because in our experiment we simulated, although not to as great a degree, the damage wasn't as severe, but I think it would be hard to say that.

One thing comes to my mind right now that might indicate it. There was a greater flattening of the bullet in our experiments than there was going through the Governor, which might indicate that it struck the rib which did the flattening at a lower velocity. This is only a thought.

Mr. SPECTER. It struck the rib of the Governor?

Dr. OLIVIER. It struck the rib of the Governor at a lower velocity because that bullet was less flattened than the bullet through the goat material.

Mr. SPECTER. Based on the nature of the wound inflicted on the Governor's wrist, and on the tests which you have conducted then, do you have an opinion as to which is more probable on whether the bullet passed through only the Governor's chest before striking his wrist, or passed through the President first and then the Governor's chest before striking the Governor's wrist?

Dr. OLIVIER. Will you say that again to make sure I have it?

Mr. SPECTER. [To the reporter.] Could you repeat that question, please? (The question was read by the reporter.)

Dr. OLIVIER. You couldn't say exactly at all. My feeling is that it would be

more probable that it passed through the President first. At least I think it is important to establish line of flight to try to determine it.

Mr. SPECTER. Aside from the lines of flight, based on the factors which were known to you from the medical point of view and from the tests which you conducted, what would be the reason for the feeling which you just expressed?

Dr. OLIVIER. Because I believe you would need that, I mean to account for the damage to the wrist. I don't think you would have gotten a low enough velocity upon reaching the wrist unless you had gone through the President's body first.

Mr. SPECTER. The President's body as well as the Governor's body?

Dr. OLIVIER. As well as the Governor's.

Mr. SPECTER. Does the nature of the wound which was inflicted on Governor Connally's thigh shed any light on this subject?

Dr. OLIVIER. This, to my mind, at least, merely indicates the bullet at this time was about spent. In talking with doctor, I believe it was Gregory, I don't think he did the operation on the thigh but at least he saw the wound, and he said it was about the size of an eraser on a lead pencil. This could be accounted for—and there was also this small fragment of bullet in this thigh wound—this, to me, indicates that this was a spent bullet that had gone through the wrist as the Governor was sitting there, went through the wrist into his thigh, just partly imbedded and then fell out and I believe this was the bullet that was found on the stretcher.

Mr. SPECTER. Would you have any opinion as to the velocity of that bullet at the time it struck the Governor's thigh?

Dr. OLIVIER. No. We didn't do any work to simulate this, but it would have been at a very low velocity just to have gone in that far and drop out again.

Mr. SPECTER. Dr. Olivier, in the regular course of your work for the U.S. Army, do you have occasion to perform tests on reconstructed human skulls to determine the effects of bullets on skulls?

Dr. OLIVIER. Yes; I do.

Mr. SPECTER. And did you have occasion to conduct such a test in connection with the series which you are now describing?

Dr. OLIVIER. Yes; I did.

Mr. SPECTER. And would you outline briefly the procedures for simulating the human skull?

Dr. OLIVIER. Human skulls, we take these human skulls and they are imbedded and filled with 20 percent gelatin. As I mentioned before, 20 percent gelatin is a pretty good simulant for body tissues.

They are in the moisture content. When I say 20 percent, it is 20 percent weight of the dry gelatin, 80 percent moisture.

The skull, the cranial cavity, is filled with this and the surface is coated with a gelatin and then it is trimmed down to approximate the thickness of the tissues overlying the skull, the soft tissues of the head.

Mr. SPECTER. And at what distance were these tests performed?

Dr. OLIVIER. These tests were performed at a distance of 90 yards.

Mr. SPECTER. And what gun was used?

Dr. OLIVIER. It was a 6.5 Mannlicher-Carcano that was marked Commission Exhibit 139.

Mr. SPECTER. What bullets were used?

Dr. OLIVIER. It was the 6.5 millimeter Mannlicher-Carcano Western ammunition lot 6,000.

Mr. SPECTER. What did that examination or test, rather, disclose?

Dr. OLIVIER. It disclosed that the type of head wounds that the President received could be done by this type of bullet. This surprised me very much, because this type of a stable bullet I didn't think would cause a massive head wound, I thought it would go through making a small entrance and exit, but the bones of the skull are enough to deform the end of this bullet causing it to expend a lot of energy and blowing out the side of the skull or blowing out fragments of the skull.

Mr. SPECTER. I now hand you a case containing bullet fragments marked Commission Exhibit 857 and ask if you have ever seen those fragments before.

Dr. OLIVIER. Yes, I have.

Mr. SPECTER. And under what circumstances have you viewed those before, please?

Dr. OLIVIER. There were, the two larger fragments were recovered outside of the skull in the cotton waste we were using to catch the fragments without deforming them. There are some smaller fragments in here that were obtained from the gelatin within the cranial cavity after the experiment. We melted the gelatin out and recovered the smallest fragments from within the cranial cavity.

Mr. SPECTER. Now, I show you two fragments designated as Commission Exhibits 567 and 579 heretofore identified as having been found on the front seat of the President's car on November 22, 1963, and ask you if you have had an opportunity to examine those before.

Dr. OLIVIER. Yes, I have.

Mr. SPECTER. And have you had an opportunity to compare those to the two fragments identified as Commission Exhibit 857?

Dr. OLIVIER. Yes, I have.

Mr. SPECTER. And what did that comparison show?

Dr. OLIVIER. They are quite similar. These two fragments on, what is the number?

Mr. SPECTER. 857.

Dr. OLIVIER. On 857 there isn't as much of the front part in this one, but in other respects they are very similar.

Mr. SPECTER. I now hand you a photograph marked Commission Exhibit 858 and ask you what that depicts.

Mr. DULLES. Could I see that other exhibit?

Dr. OLIVIER. These are the same fragments as marked 857.

Mr. SPECTER. That is a photograph of the fragments marked 857?

Dr. OLIVIER. 857.

Mr. SPECTER. I now hand you a photograph marked Commission Exhibit 859 and ask you what that depicts?

Dr. OLIVIER. These are the smaller fragments that have been labeled, also, Exhibit 857. This picture or some of the fragments labeled 857, these are the smaller fragments contained in the same box.

Mr. SPECTER. Are all of the fragments on 859 contained within 857?

Dr. OLIVIER. They are supposed to be, photographed and placed in the box. If they dropped out they are supposed to be all there.

(Discussion off the record.)

Mr. DULLES. Back on the record.

Mr. SPECTER. At what point on the skull did the bullet, which fragmented into Commission Exhibit 857, strike?

Dr. OLIVIER. I would have to see the picture. I mean I can't remember exactly what point. I can tell you the point we were aiming at and approximately where it hit.

Mr. SPECTER. Permit me to make available a photograph to you, then, for purposes of refreshing your recollection, and in testifying as to the point which was struck, for that purpose.

Dr. OLIVIER. We did 10 skulls so I can't remember offhand where everyone struck.

Mr. SPECTER. For that purpose I hand you Commission Exhibit 860 and ask you if that is designated in any way to identify it.

Mr. DULLES. This is the test we are talking about now, is it?

Mr. SPECTER. Yes, sir; where the bullet fragmented into pieces in 857.

Mr. DULLES. Are you introducing that into evidence?

Mr. SPECTOR. Yes, sir.

Mr. DULLES. Have you already introduced it in the record?

Mr. SPECTOR. May I at this point move for the admission into evidence of Commission Exhibits 844 through 860, and they have been identified in sequence as being the photographs, X-rays, and other tangible exhibits used in connection with these tests.

Mr. DULLES. They shall be admitted.

(The documents heretofore marked for identification as Commission Exhibits Nos. 844 through 860 were received in evidence.)

Dr. OLIVIER. This photograph is the skull that was shot with the bullet, the fragments which are marked 857.

Mr. SPECTER. At what point on the skull did the bullet strike?

Dr. OLIVIER. From this I couldn't tell you exactly the point. We were aiming, as described in the autopsy report if I remember correctly the point 2 centimeters to the right of the external occipital protuberance and slightly above it. We placed a mark on the skull at that point, according to the autopsy the bullet emerged through the superorbital process, so we drew a line to give us the line of flight, put unclipped goat hair over the back to simulate the scalp and put a mark on the area which we wished to shoot.

Now, every shot didn't strike exactly where we wanted, but they all struck in the back of the skull in the vicinity of our aiming point, some maybe slightly above the external occipital protuberance. In some cases very close to our aiming spot.

This particular skull blew out the right side in a manner very similar to the wounds of the President, and if I remember correctly, it was very close to the point at which we aimed.

In other words, a couple centimeters to the right.

Mr. SPECTER. Do you have any record which would be more specific on the point of entrance?

Dr. OLIVIER. Our notebook has all——

Mr. SPECTER. Will you refer to your notes, then?

Dr. OLIVIER. The notebook is in the safe in there in the briefcase.

Mr. SPECTER. Would you get the notebook and refer to it so we can be as specific as possible on this point.

Dr. OLIVIER. I have the location of that wound.

Mr. SPECTER. Would you give us then the precise location of the wound caused by bullet identified as 857?

Dr. OLIVIER. The entrance wound is 2.9 centimeters to the right and almost horizontal to the occipital protuberance. This is almost exactly where we were aiming. We were aiming 2 centimeters to the right.

Mr. SPECTER. I now hand you a photograph marked as Commission Exhibit 861, move its admission into evidence, and ask you to state what that depicts.

Dr. OLIVIER. This is the skull in question, the same one from which the fragments marked Exhibit 857 were recovered.

Mr. SPECTER. And what does that show as to damage done to the skull?

Dr. OLIVIER. It blew the whole side of the cranial cavity away.

Mr. SPECTER. How does that compare, then, with the damage inflicted on President Kennedy?

Dr. OLIVIER. Very similar. I think they stated the length of the defect, the missing skull was 13 centimeters if I remember correctly. This in this case it is greater, but you don't have the limiting scalp holding the pieces in so you would expect it to fly a little more but it is essentially a similar type wound.

Mr. SPECTER. Does the human scalp work to hold in the human skull in such circumstances to a greater extent than the simulated matters used?

Dr. OLIVIER. Yes; we take this into account.

Mr. SPECTER. I hand you Commission Exhibit 862, move its admission into evidence, and ask you what that depicts?

Dr. OLIVIER. This is the same skull. This is just looking at it from the front. You are looking at the exit. You can't see it here because the bone has been blown away, but the bullet exited somewhere around—we reconstructed the skull. In other words, it exited very close to the superorbital ridge, possibly below it.

Mr. SPECTER. Did you formulate any other conclusions or opinions based on the tests on firing at the skull?

Dr. OLIVIER. Well, let's see. We found that this bullet could do exactly—could make the type of wound that the President received.

Also, that the recovered fragments were very similar to the ones recovered on the front seat and on the floor of the car.

This, to me, indicates that those fragments did come from the bullet that wounded the President in the head.

Mr. SPECTER. And how do the two major fragments in 857 compare, then, with the fragments heretofore identified as 567 and 569?

Dr. OLIVIER. They are quite similar.

Mr. SPECTER. Do you have an opinion as to whether the wound on the Governor's wrist could have been caused by a fragment of a bullet coming off of the President's head?

Dr. OLIVIER. I don't believe so. Frankly, I don't know, but I don't believe so, because it expended so much energy in blowing the head apart and took a lot of energy that I doubt if they could have fractured the radius. The radius is a very strong, hard bone and I don't believe they could have done that much damage. I believe they could have caused a superficial laceration on someone or a mark on the windshield, but I don't believe they could have done that damage to the wrist.

Mr. DULLES. And it couldn't have then gone through the wrist into the thigh?

Dr. OLIVIER. I don't believe so.

Mr. SPECTER. Have you had an opportunity to examine a fragment identified as Commission Exhibit 842 which is the fragment taken from Governor Connally's wrist?

Dr. OLIVIER. Yes, I have.

Mr. SPECTER. Could that fragment have come from the bullet designated as Commission Exhibit 399?

Dr. OLIVIER. Yes, I believe it would have, I will add further I believe it could have because the core of the bullet extrudes through the back and would allow part of it to break off very readily.

Mr. SPECTER. Do you have an opinion as to whether, in fact, bullet 399 did cause the wound on the Governor's wrist, assuming if you will that it was the missile found on the Governor's stretcher at Parkland Hospital?

Dr. OLIVIER. I believe that it was. That is my feeling.

Mr. SPECTER. To be certain that the record is complete on the skull tests, would you again state the distance at which those tests were performed?

Dr. OLIVIER. Yes, the skulls—it was fired at the skulls at a range of 90 yards.

Mr. SPECTER. With what gun?

Dr. OLIVIER. The 6.5 mm. Carcano which was marked Commission Exhibit 139 and using Western ammunition lot 6,000, again the 6.5 mm. Mannlicher-Carcano.

Mr. SPECTER. Going to the results of the test on the cadavers, what was the average exit velocity?

Dr. OLIVIER. The average exit velocity on the wrist was 1,776 feet per second.

Mr. SPECTER. Had Governor Connally's wrist been struck with a pristine bullet and the bullet exited at that speed, what damage would have been inflicted had it then struck the area of the thigh which was struck on the Governor according to the Parkland Hospital records which you have said you have examined?

Dr. OLIVIER. It would have made a very severe wound.

Mr. SPECTER. Would it have been more severe than the one which was inflicted?

Dr. OLIVIER. Much more so.

Mr. SPECTER. Do you have anything to add, Dr. Olivier, which you think would be helpful to the Commission in any way?

Dr. OLIVIER. No; I don't believe so.

Mr. DULLES. I have no further questions.

Mr. SPECTER. That completes my questions, Mr. Dulles.

Mr. DULLES. Thank you very much. We appreciate very much your coming.

(Discussion off the record.)

TESTIMONY OF DR. ARTHUR J. DZIEMIAN

Mr. SPECTER. Dr. Dziemian.

Mr. DULLES. Doctor, will you raise your right hand, please? Do you solemnly swear the testimony you give in this proceeding is the truth, the whole truth, and nothing but the truth, so help you God?