telescopic crosshair ring is mounted in a telescope.

Mr. Eisenberg. This is a generalized diagram, rather than a diagram of the specific scope on Exhibit 139?

Mr. Frazier. Yes, it is. However, I have checked the scope on Exhibit 139 and found it to be substantially the same as this diagram.

Mr. Eisenberg. Mr. Chairman, may I have this admitted as 555?

Mr. McCloy. It may be admitted.

(The document referred to was marked Commission Exhibit 555 for identification, and received in evidence.)

Mr. Frazier. Commission Exhibit No. 555 is a diagrammatic drawing of the manner in which the crosshair ring is mounted in Exhibit 139, showing on the right-hand side of the diagram a circular drawing indicating the outer part of the tube with an inner circle with a crossed line in it representing the cross-hairs in the telescope.

There is an elevation adjusting screw at the top, which pushes the crosshair ring down against a spring located in the lower left-hand portion of the circle, or which allows the crosshair ring to come up, being pushed by the spring on the opposite side of the ring. There is a windage screw on the right-hand side of the scope tube circle which adjusts the crosshair ring laterally for windage adjustments.

The diagram at the left side of Commission's Exhibit 555 shows

diagrammatical., the b[illegible] mounted in the telescope tube which causes the ring to be pressed against the ~~mounting~~ adjusting screws.

We found in this t[illegible] scope sight on this rifle that this ring was shifting in the telescope tube so that the gun could not be sighted in merely by changing the screws. It was necessary to adjust it, and then fire several shots to stabilize the crosshair ring by causing this spring to press tightly against the screws to the point that we decided it would not be feasible to completely sight the weapon in as far as windage goes, and in addition found that the elevation screw could not be adjusted sufficiently to bring the point of impact on the targets down to the ~~[redacted]~~ sighting point.

And, therefore, we left the rifle as soon as it became stabilized and fired all of our shots with the point of impact actually high and to the right.

Mr. Eisenberg. As I understand it, the construction of the scope is such that after the elevation or windage screw has been moved, the scope does not-- is not automatically pushed up by the blade spring as it should be until you have fired several shots?

Mr. Frazier. Yes, that is true -- when the crosshairs are largely out of the center of the tube. And in this case it is necessary to move the crosshairs completely up into the upper portion of the tube, which causes this spring to bear in a position out of the ordinary, and for this windage screw to strike the side

or the sloping surface of the ring rather than at 90 degrees, as it shows in Exhibit 555. With this screw being off center, not in windage and elevation, the spring is not strong enough to cent the crosshair ring by itself, and it is necessary to jar it, several times, which we did by firing, to bring it to bear tightly so as to maintain the same position then for the next shots.

Mr. Eisenberg. And because of the difficulty you had stabilizing the crosshair, you did not wish to pursue it to a further refinement, is that correct?

Mr. Frazier. We sighted the scope in relatively close, fired it, and decided rather than fire more ammunition through the weapon, we would use these targets which we had fired.

Mr. Eisenberg. Now, once the crosshairs had been stabilized did you find that they stayed, remained stabilized?

Mr. Frazier. Yes, they did.

Mr. Eisenberg. How long do you think the crosshairs would remain stabilized in Exhibit 139 assuming no violent jar?

Mr. Frazier. They should remain stabilized continuously.

Mr. Eisenberg. Do you know when the defect in this scope which causes you not to be able to adjust the elevation crosshair in the manner it should be -- do you know when the defect was introduced into the scope?

Mr. Frazier. No, I do not. However, on the back end of the scope tube there is a rather severe scrape which was on this

weapon when we received it in the laboratory, in which some of the metal has been removed, and the scope tube could have been bent or damaged.

Mr. Eisenberg. Did you first test the weapon for accuracy on November 27th?

Mr. Frazier. Yes, sir.

Mr. Eisenberg. Have you any way of determining whether the defect preexisted November 27th?

Mr. Frazier. When we fired on November 27th, the shots were landing high and slightly to the right. However, the scope was apparently fairly well stabilized at that time, because three shots would land in an area the size of a dime under rapid fire conditions which would not have occurred if the [redacted] interior mechanism of the scope was shifting.

Mr. Eisenberg. But you are unable to say whether -- or are you able to say whether the defect existed before November 27th? That is, precisely when it was introduced

Mr. Frazier. As far as to be unable to adjust the scope actually, I could not say when it had been introduced. I don't know actually what the cause is. It may be that the mount has been bent or the crosshair ring shifted.

Mr. Eisenberg. Mr. Frazier, when you were running, let's say, the last test, could you have compensated for this defect?

Mr. Frazier. Yes, you could take an aiming point low and to the left and have [redacted]

~~directed to procure~~ the shots strike a predetermined point. But it would be no different from taking these targets and putting an aiming point in the center of the bullet impact area. Here that would be the situation you would have -- an aiming point off to the side and an impact area at the high right corner.

Mr. Eisenberg. If you had been shooting to score bull's-eyes, in a bull's-eye pattern, what [illegible] you have -- what action, if any, would you have taken, to [illegible] your score?

Mr. Frazier. I would [illegible] and to the left -- after finding how high the bullets were landing; you would compensate by aiming low left, or adjusting the mount of the scope ~~the~~ in a manner which would cause the hairlines to coincide with the point of impact.

Mr. Eisenberg. How much practice had you had with the rifle before the last series of four targets were shot by you?

Mr. Frazier. I ~~have~~ had fired it possibly 20 rounds, 15 to 20 rounds, and in addition had operated the bolt repeatedly.

Mr. Eisenberg. Does practice with this weapon, or would practice with this weapon materially shorten the time in which three shots could be accurately fired?

Mr. Frazier. Yes, sir, very definitely.

Mr. Eisenberg. Would practice without actually firing the weapon be helpful -- that is, a dry run practice?

Mr. Frazier. That would be most helpful, particularly in a bolt action weapon, where it is necessary to shift your hand

from the trigger area to the bolt, operate the bolt, and go back to the trigger after closing the bolt.

Mr. Eisenberg. Based on your experience with the weapon, do you think three shots could be fired accurately within 5-1/2 seconds if no rest was utilized?

Mr. Frazier. That would depend on the accuracy which was necessary or needed or which you desired. I think you could fire the shots in that length of time, but whether you could place them, say, in a three or four inch circle without either resting or possibly using the sling as a support--I doubt that you could accomplish that.

Mr. Eisenberg. How -- are these targets at which you fired stationary at 100 yards -- how do you think your time would have been affected by use of a moving target?

Mr. Frazier. It would have slowed down the shooting. It would have lengthened the time to the extent of allowing the crosshairs to pass over the moving target.

Mr. Eisenberg. Could you give an amount?

Mr. Frazier. Approximately one second. It would depend on how fast the target was moving, and whether it was moving away from you or towards you or at right angles.

Mr. Eisenberg. Do you think you could shorten your time with further practice with the weapon?

Mr. Frazier. Oh, yes.

Mr. Eisenberg. Could you give us an estimate on that?

Mr. Frazier. I fired three shots in 4.6 seconds at 25 yards with approximately a three inch spread, which is the equivalent of a 12 inch spread at a hundred yards. And I feel that a 12 inch relative circle could be reduced to six inches or even less with considerable practice with the weapon.

Mr. Eisenberg. That is in the 4.6 second time?

Mr. Frazier. Yes. I would say from 4.8 to 5 seconds, in that area -- 4.6 is firing this weapon as fast as the bolt can be operated, I think.

Mr. Eisenberg. I am going to ask you several hypothetical questions concerning the factors which might have affected the aim of the assassin on November 22nd, and I would like for you to make the following assumptions in answering these questions First, that the assassin fired his shots from the window near which the cartridges were found -- that is, the easternmost window on the south face of the sixth floor of the School Book Depository Building, which is 60 feet above the ground, and several more feet above the position at which the car was apparently located when the shots were fired.

Second, that the length of the trajectory of the first shot was 175 feet, and that the length of the trajectory of the third shot was 265 feet.

And, third, that the elapsed time between the firing of the first and third shots was 5-1/2 seconds.

Based on those assumptions, Mr. Frazier, approximately what

lead would the assassin have had to give his target to compensate for its movement -- and here I would disregard any possible defect in the scope.

Mr. Frazier. I would say he would have to lead approximately two ~~inches~~ feet under both such situations. The lead would, of course be dependent upon the direction in which the object was moving primarily. If it is moving away from you, then, of course, the actual lead of, say, two feet which he would have to lead would be interpreted ~~only~~ as a considerably less lead in elevation above the target, because the target will move the two feet in a direction away from the shooter, and the apparent lead then would be cut to one foot or 12 inches or eight inches or something of that nature, due to the movement of the individual.

Mr. Eisenberg. Have you made calculations to achieve the figures you give?

Mr. Frazier. I made the calculations, but I don't have them ~~Since then~~. with me.

Mr. Eisenberg. Could you supply these to us, either in further testimony or by letter, Mr. Frazier?

Mr. Frazier. I have one object here, a diagram which will illustrate that lead, if you would like to use that. This is drawn to scale from those figures which you quoted as building height and distance of 175 feet, [illegible] feet.

Mr. Eisenberg. For the record, those figures are approximations of the figures believed [illegible] involved in the assassination.

Will you supply the data at a later date?

Mr. Frazier. Yes, I can furnish that.

Mr. Eisenberg. May I have permission to introduce this as 556?

Mr. McCloy. That will be admitted.

(The document referred to was marked Commission Exhibit 556 for identification, and received in evidence.)

Mr. Eisenberg. Could you show the lead in that diagram, Mr. Frazier?

Mr. Frazier. In Commission Exhibit 556, it shows a triangular diagram with the vertical line on the left-hand side illustrating the height of the building. The figures of a 60-foot building height plus --

Mr. Eisenberg. That is height of the muzzle above the ground?

Mr. Frazier. No -- window sill -- 60 foot window sill height above the ground, with an assumed two foot height in addition to accommodate the height of the rifle above the possible -- the possible height of the rifle above the window sill.

The horizontal line extending outward from the building to a small rectangular block, and then a sloping line illustrating a five foot slope from the 175 foot point to the 265 foot point.

(At this point, Representative Boggs entered the hearing room.)

Mr. Frazier. The time of flight of the bullet of approximately

of a second. And, again, it was necessary to assume -- the time of flight of the bullet from the window to this first location of 175 feet is approximately 1/10 of a second, which means a two foot lead on the target. That is, the target would move two feet in that interval of time, thereby necessitating shooting slightly ahead of the target to hit your aiming point. That has been diagrammatically illustrated by a two foot distance laid off on this rectangular block here, and two lines, very fine lines, drawn back towards the window area.

The right-hand side of Commission's 556 shows the same rectangular block, again with two lines drawn to it, one illustrating the point of aim and the other the amount of lead which would be necessary to strike an object aimed at which was moving, according to the time of flight of the projectile.

Mr. Eisenberg. And you calculated the speed of the car by translating the figures on total time elapsed between first and third shots?

Mr. Frazier. Yes, sir. The time -- the speed of the moving object was calculated on the basis of an assumed 5.5 second interval for a distance of 90 feet, which figures out mathematically to be 11.3 miles per hour.

Mr. Eisenberg. Now, you said before that in order to give this two foot lead, you would have to aim two inches -- a target going away from you, you would have to aim two inches above the target? Or in front of the target?

Mr. Frazier. Two feet in front of the target, which would interpolate into a much lower actual elevation change.

Mr. Eisenberg. The elevation change would be two inches, is that it?

Mr. Frazier. Well, no. It would be on the order of six to eight inches.

Mr. Eisenberg. Six to eight inches?

Mr. Frazier. Yes.

Mr. Eisenberg. What was your two inch figure?

Mr. Frazier. I don't recall.

Mr. Eisenberg. But it is six to eight inches in elevation?

Rep. Boggs. May I ask a question?

Using that telescopic lens, how would you aim that rifle to achieve that distinction?

Mr. Frazier. Well, it would be necessary to hold the cross-hairs an estimated distance off the target, of say, six inches over the intended target, so that when the shot was fired the crosshairs should be located about six inches over your target, and in the length of time that the bullet was in the air and the length of time the object was moving, the object would move into, actually, the path of the bullet in approximately one-tenth to 13/100ths of a second.

Mr. Eisenberg. So that if the target of the assassin was the center of the President's head, and he wanted to give a correct lead, where would he have aimed if we eliminate the

possibility of errors introduced by other factors?

Mr. Frazier. He would aim from four to six inches -- approximately two inches, I would say, above the President's head, which would be actually six inches above his aiming point at the center of the head.

Mr. Eisenberg. How difficult is it to give this -- a lead of this size to this type of target?

Mr. Frazier. It would not be difficult at all with a telescope sight, because your target is enlarged four times, and you can estimate very quickly in a telescope sight, inches or feet or lead of any desired amount.

Mr. Eisenberg. Would it be substantially easier than it would be with an open or peep sight?

Mr. Frazier. Yes. It would be much more difficult to do with the open iron sights, the notched rear sight and the blade front sight, which is on Exhibit 139.

Mr. Eisenberg. Now, you have been able to calculate the precise amount of lead which should be given, because you have been giving figures. If you had been in the assassin's position, and were attempting to give a correct lead, what lead do you think you would have estimated as being the necessary lead?

Mr. Frazier. It would have been a very small amount, in the neighborhood of a three inch lead.

Mr. Eisenberg. As opposed to the six or eight inches?

Mr. Frazier. As opposed to about six inches, yes.

Mr. Eisenberg. What would the consequence of the mistake in assumptions as to lead be -- that is, if you gave a three inch lead rather than the correct lead?

Mr. Frazier. It would be a difference ~~in~~ of a three inch variation in the point of impact on the target.

Mr. Eisenberg. Now, if you had aimed at the center of the President's head, and given a three inch lead, again eliminating other errors, where would you have hit, if you hit accurately?

Mr. Frazier. It would be three inches below the center of his head -- from the top -- it would be not the actual center from the back, but the center would be located high. The bullet would strike at possibly the base of the skull.

Mr. Eisenberg. Now, suppose you had given no lead at all and aimed at that target and aimed accurately. Where would the bullet have hit?

Mr. Frazier. It would hit the base of the neck -- approximately six inches below the center of the head.

Mr. Eisenberg. Mr. Frazier, would you have tried to give a lead at all, if you had been in that position?

Mr. Frazier. At that range, at that distance, 175 to 265 feet, with this rifle and that telescope sight, I would not have allowed any lead -- I would not have made any correction for lead merely to hit a target of that size.

Mr. McCloy. May I ask a question?

In your experimentation, in your firing of those shots that

you have ~~had~~ fired to a little while ba(, when you fired the first shot, was the shot in the chamber, or did you have to push it into the chamber by use of the bolt?

Mr. Frazier. This was fired with a loaded chamber, and timed from the time of this first shot until the last shot.

Mr. McCloy. Did you shoot off-hand or did you shoot with a rest?

Mr. Frazier. We shot with a rest, both the other individuals and myself, on each occasion, with one arm resting on a bench or a table.

Mr. McCloy. Were you prone, or were you standing up?

Mr. Frazier. Well, we were sitting, actually, sitting or kneeling, in order to bring the arm down to the rest we were using.

Mr. McCloy. One other question.

You keep referring [illegible] questions kept referring to lead. By lead, in this [illegible], you would mean height above the aiming point rather [illegible] --

Mr. Frazier. Yes, sir.

Mr. McCloy. -- to the right, let's say, of the aiming point.

Mr. Frazier. Yes, sir, that is correct.

Mr. McCloy. Because it was a going away shot.

Mr. Frazier. Yes, sir.

Mr. McCloy. That is all.

Rep. Boggs. May I ask a question?

Where did you conduct these tests?

Mr. Frazier. The targets were fired both on the indoor range--in the F.B.I. range here in Washington, and the 100 yard tests were fired at the Quantico, Virginia, F.B.I. ranges.

Rep. Boggs. Have any tests -- have there been any simulated tests in the building in Texas?

Mr. Frazier. I don't know, sir.

Rep. Boggs. But the F.B.I. has not conducted any?

Mr. Frazier. Not to my knowledge. There may have been measurements and things of that nature taken, but I don't know.

Rep. Boggs. Now, in these tests, was there any difficulty about firing this rifle three times within the space or period of time that has been given to the Commission -- five seconds, I think.

Mr. Frazier. Well, let me say this. I fired the rifle three times, in accordance with that system of timing it from the first shot with the chamber loaded until the last shot occurred -- three times in 4.6 seconds, 4.[illegible] seconds, 5.8, 5.9, and another one a little o[illegible] in that neighborhood. The tenth of a second variation could [illegible] be as a result of the timing procedure used. A matter of just not stopping the stopwatch in a tenth of a second.

Rep. Boggs. You were firing at a simulated target?

Mr. Frazier. ~~[illegible]~~ Those targets, previously introduced, or copies of the targets which we actually fired.

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Rep. Boggs. My questions are really follow-up of the Chairman's question.

These practices -- were you just practicing for time, or were you practicing under conditions similar to those existing in Dallas at the time of the assassination?

Mr. Frazier. The tests we ran were for the purposes of determining whether we could fire this gun accurately in a limited amount of time, and specifically to determine whether it could be fired accurately in six seconds.

Now, we assumed the six seconds empirically -- that is, we had not been furnished with any particular time interval. Later we were furnished with a time interval of 5.5 seconds. However, I have no independent knowledge -- had no independent knowledge of the time interval or the accuracy. But we merely fired it to demonstrate the results from rapidly firing the weapon, re-loading the ~~bolt~~ gun and so on, in a limited time.

Rep. Boggs. Were there other tests conducted to determine the accuracy of the weapon and so on?

Mr. Frazier. No, sir -- only the rapid fire-accuracy tests were fired by the FBI.

Rep. Boggs. There is no reason to believe that this weapon is not accurate, is there?

Mr. Frazier. It is a very accurate weapon. The targets we fired show that.

Rep. Boggs. That was the point I was trying to establish.

2 ajl

Mr. Frazier. This Exhibit 949 is a target fired, showing that the weapon will, even under rapid-fire conditions, group closely -- that is, one shot with the next.

Rep. Boggs. How may shots in the weapon? Five?

Mr. McCloy. The clip takes six itself. You can put a seven in the chamber. It could hold seven, in other words. But the clip is only a six-shot clip.

Rep. Boggs. Was the weapon fully loaded at the time of the assassination?

Mr. McCloy. I don't know how many shells -- three shells were picked up.

Mr. Eisenberg. Off the record.

(Discussion off the record.)

Mr. McCloy. Back on the record.

Mr. Eisenberg. Mr. Frazier, turning back to the scope, if the elevation cross-hair was defective at the time of the assassination, in the same manner it is now, and no compensation was made for this defect, how would this have inter-acted with the amount of lead which needed to be given to the target?

Mr. Frazier. Well, may I say this first. I do not consider the cross-hair as being defective, but only the adjusting mechanism does not have enough tolerance to bring the cross-hair to the point of impact of the bullet. As to how that would affect the lead, the gun, when we first received it in the laboratory and fired those first targets, shot high and slightly to the right.

jl If you were shooting at a moving target from a high elevation, relatively high elevation, moving away from you, it would be necessary for you to shoot over that object in order for the bullet to strike your intended target, because the object during the flight of the bullet would move a certain distance.

The fact that the cross-hairs are set high would actually compensate for any lead which had to be taken. So that if you aimed with this weapon as it actually was received at the laboratory, it would be necessary to take no lead whatsoever in order to hit the intended object. The scope would accomplish the lead for you.

I might also say that it also shot slightly to the right, which would tend to cause you to miss your target slightly to the right.

Mr. Eisenberg. Now, in that last question, did you attempt to center the windage crosshair, to sight in the windage cross-hair?

Mr. Frazier. We attempted to, and found that it was changing-the elevation was changing the windage. So we merely left the windage as it was.

Mr. Eisenberg. Can you say conclusively that the windage cross-hair could not be centered in, sighted in?

Mr. Frazier. No, sir. I would say that the windage could have been centered in the telescope to bring the windage to the aiming line.

4 ajl

Mr. Eisenberg. So that -- and if that had been done, then you would not have this problem of dispersion to the right?

Mr. Frazier. That's true.

Mr. Eisenberg. Now, turning to --

Rep. Boggs. Excuse me just a moment. Do you have any opinion on whether or not the sight was deliberately set that way?

Mr. Frazier. No, sir, I do not. And I think I must say here that this mount was loose on the rifle when we received it. And apparently the scope had even been taken off of the rifle, in searching for fingerprints on the rifle. So that actually the way it was sighted in when we got it does not necessarily mean it was sighted in that way when it was abandoned.

Mr. Eisenberg. Continuing this question a little bit further on the deliberateness of the sighting in, the problem with the elevation cross-hair is [illegible] the mounting of the scope, is that correct?

Mr. Frazier. Yes [illegible] is not screwed to the rifle in such a fashion that it centers the scope at the target closely enough to permit adjusting the cross-hair to accurately sight in the rifle.

Rep. Boggs. One other question, then.

It is possible, is it not, to so adjust the telescopic sight to compensate for that change in the target?

Mr. Frazier. Oh, yes. You can accomplish that merely by putting shims under the front of the scope and even the back of

ajl the scope to tip the scope in the mount itself, to bring it in.

Rep. Boggs. So an accomplished person, accustomed to using that weapon, anticipating a shot of that type, might very well have made such an adjustment prior to using the rifle; isn't tha so?

Mr. Frazier. If it were necessary, yes. There were no shim in the weapon, either under the mount, where it screws to the weapon, or in the two mounting rings when we received it ~~from~~ in the laboratory.

Mr. Eisenberg. Do you have any shims with you, Mr. Frazier?

Mr. Frazier. Yes. When we received the weapon yesterday, there were shims mounted in the rifle. The one under the front end of the mount is in this envelope.

Rep. Boggs. But they were not there when you received it originally?

Mr. Frazier. No, sir. These were placed there by some other individual.

Mr. Eisenberg. For the record, these were placed by the ballistics laboratory of the army, a representative of which will testify later.

Now, turning to another possible source of error in aim, Mr. Frazier, if a rifle such as Exhibit 139 is sighted in with the use of a target at a given distance, and it is aimed at a target which is further away or closer than the target which was used for sighting in purposes, will any error be introduced by reason of

the fact that the target is further or closer away than the sighting in target?

Mr. Frazier. Yes, it will, because the bullet in leaving the muzzle follows a curved path rather than a straight path, and in order to hit a specific target at a specific range, it is necessary for the bullet to travel up and drop down to the target, rather than have the [illegible] sighted right at the target at the time of discharge.

Mr. Eisenberg. Can you calculate the amount of error which would be introduced [illegible] projectile?

Mr. Frazier. Yes.

Mr. Eisenberg. [illegible] such calculations?

Mr. Frazier. I have taken calculations from similar weight and velocity bullets [illegible] ballistics tables, which bullets approximate the velocity of the 6.5. mm. bullet and the weight of that bullet as fired from 139.

Mr. Eisenberg. Are these results affected by the rifle which is employed, or do they depend upon the missile?

Mr. Frazier. They depend upon the weight and shape of the missile and the velocity, but not upon the weapon.

Mr. Eisenberg. Could you give us the results of those calculations?

Mr. Frazier. Yes, sir. If you, for instance, take this rifle with a telescope sight and sight it in for 300 feet -- that is, the bullet will strike where you are looking when you are shooting at

300 feet, at ( ) feet the bullet will be above the line of sight approximately one-quarter of an inch, and at 100 feet it will be approximately one-quarter of an inch below the line of sight. That is accomplished because the bullet is still coming up at 100 feet, it crosses the line of sight, and does not descend again to it until you come to the sighting-in distance of 300 feet.

If you sighted in to strike at 450 feet, the bullet at 100 feet would be just at the line of sight -- that is, on its way up would just cross the line of sight at about 100 feet. It would be one inch high at 200 feet, and approximately one and one-eighth inches high at 300 feet.

It would, of course, drop back down to the point of aim at 450 feet. If you sighted in at 600 feet, then at 100 feet it would be approximately one-half inch high. At 200 feet it would be two inches high, and at 300 feet it would be approximately three inches high.

Rep. Boggs. Is this a stationary target?

Mr. Frazier. Yes, this is shooting from a rest at a stationary target.

Rep. Boggs. This is just a normal --

Mr. Frazier. This is just the trajectory of the bullet.

Rep. Boggs. I understand.

Mr. Frazier. As calculated --

Mr. McCloy. Putting it another way, what would be the drop of the bullet at a hundred yards if you aim point-blank straight

at that target?

Mr. Frazier. Assuming no sighting or anything, the bullet would drop about 1.2 inches from the line of the bore at 100 yards.

Rep. Boggs. 1.2 inches?

Mr. Frazier. Yes, sir.

Rep. Boggs. But now the telescopic sight at a hundred yards would correct that?

Mr. Frazier. Yes, sir. Actually, you would sight so that the muzzle is tipped up slightly with reference to the sight.

Mr. Eisenberg. The error would be introduced if you shot at a target which is closer or further away than the sighting-in target; is that correct?

Mr. Frazier. Yes, that's right.

Mr. Eisenberg. Would you characterize these errors as material?

Mr. Frazier. No, sir, I would not -- unless you began shooting at distances well beyond your sighting-in point -- then the amount of variation increases very rapidly.

Mr. Eisenberg. What would be the usual minimum distance you use for sighting-in a weapon such as Exhibit 139?

Mr. Frazier. It would vary from place to place depending upon shooting conditions, and I would say it would seldom be sighted in for less than 150 or 200 yards.

Mr. Eisenberg. So that if the shots involved in the

accassination were fired at 175 feet and 265 feet respectively, they would be shorter than the sighting-in distance and therefore not materially affected by the trajectory characteristics, is that correct?

Mr. Frazier. That is correct, yes.

Mr. Eisenberg. Now, based upon the characteristics of Exhibit 139, and the ammunition it employs, and based upon your experience with the weapon, would you consider it to have been a good choice for the commission of a crime such as the assassination?

Mr. Frazier. Yes, sir, I would.

Mr. Eisenberg. Can you explain that?

Mr. Frazier. Yes. Any rifle, regardless of its caliber, would be a good choice if it would shoot accurately.

Mr. Eisenberg. And did you find this shot accurately?

Mr. Frazier. Yes, sir.

Rep. Boggs. Would you consider the shots difficult shots -- talking about the shots from the sixth-floor window to the head of the President and to Governor Connally?

Mr. Frazier. No, sir, I would not under the circumstances -- a relatively slow-moving target, and very short distance, and a telescopic sight.

Rep. Boggs. You are not answering that as an expert.

Mr. Frazier. From my own experience in shooting over the years, when you shoot at 175 feet or 260 feet, which is less than

a hundred yards with a telescopic sight, you should not have any difficulty in hitting your target.

Rep. Boggs. Putting my question another way, you would not have to be an expert marksman to accomplish this objective?

Mr. Frazier. I would say no, you certainly would not.

Rep. Boggs. And a man is a relatively large target, is he not?

Mr. Frazier. Yes, sir. I would say you would have to be ver familiar with the weapon to fire it rapidly, and do this, hit this target at those ranges. But the marksmanship is accomplished by the telescopic sight. I mean it requires no training at all to shoot a weapon with a telescopic sight once you know that you must put the cross-hairs on the target and that is all that is necessary.

Mr. Eisenberg. How does the recoil of this weapon compare with the recoil of the average military rifle?

Mr. Frazier. Considerably less. The recoil is nominal with this weapon, because it has a very low velocity and pressure, and just an average-size bullet weight.

Mr. Eisenberg. Would that tend to improve the shooter's marksmanship?

Mr. Frazier. Under rapid-fire conditions, yes.

Mr. Eisenberg. Would that make it a better choice than a more powerful recoiling weapon for the type of crime which was committed?

11 ajl

Mr. Frazier. For shooting rapidly, this would be a much better choice, because the recoil does not throw the muzzle nearly so far off the target, it does not jar the shooter nearly so much as a higher-powered rifle, such as a .30/06 or a .270 Winchester, or a German 8 mm. Mauser, for instance, or one of the other military-type weapons available.

Mr. Eisenberg. Is the killing power of the bullets essentially similar to the killing power -- at these ranges -- the killing power of the rifles you have named?

Mr. Frazier. No, sir.

Mr. Eisenberg. How much difference is there?

Mr. Frazier. The higher velocity bullets of approximately the same weight would have more killing power. This has a low velocity, but has very adequate killing power with reference to humans, because it is a military -- it is an established military weapon.

Rep. Boggs. This is a military weapon, is it not?

Mr. Frazier. Yes, sir.

Mr. McCloy. That is designed to kill a human being.

Rep. Boggs. Exactly.

Mr. Eisenberg. Unless there are further questions on the weapon, I am going to move into the area of the identification of the cartridge cases and the bullets.

Mr. McCloy. I may say I have to leave at twelve o'clock for a twelve-fifteen appointment. I will be back this afternoon.

Mr. Eisenberg. Mr. Frazier, returning to the cartridge cases which were marked earlier into evidence as Commission Exhibits 543, 544 and 545, and which, as I stated earlier for the record, had been found next to the window of the sixth floor of the T.S.B.D., can you tell us when you received those cartridge cases?

Mr. Frazier. Yes, sir. I received the first of the exhibits, 543 and 544, on November 23, 1963. They were delivered to me by Special Agent Vincent Drain of the Dallas FBI Office.

And the other one I received on November 27, 1963, which was delivered by Special Agents Vincent Drain and Warren Deimeys of the Dallas Office.

Mr. Eisenberg. After receiving these cartridge cases, did you clean them up or in any way prepare them for examination?

Mr. Frazier. Yes. The bases were cleaned of a paint which was placed on them by the manufacturer. In spots this red lacquer on the base of the case was overlapping the head of the case where some of the microscopic marks were located, and some of that color was taken off.

Mr. Eisenberg. Why is that lacquer put on the cartridge cases?

Mr. Frazier. It seals the primer area against moisture.

Mr. Eisenberg. Were there any other changes made in the preparation of the cartridge cases?

Mr. Frazier. No, sir.

all

Mr. Eisenberg. You have examined the cartridge cases previously. Are they in the same condition now that they were when you received them in the laboratory except for the cleaning of the lacquer?

Mr. Frazier. Yes, sir, they are.

Mr. Eisenberg. After receiving the cartridge cases, did you examine them to determine whether they had been fired in Commission Exhibit 139?

Mr. Frazier. Yes, sir.

Mr. Eisenberg. When did you make the examinations?

Mr. Frazier. On the dates I mentioned, [redacted] that is, November 23, 1963, and November 27, 1963.

Mr. Eisenberg. And what were your conclusions, Mr. Frazier?

Mr. Frazier. I found all three of the cartridge cases had been fired in this particular weapon.

Mr. Eisenberg. Can you describe the examination which you conducted to reach these conclusions?

Mr. Frazier. The first step was to fire test cartridge cases in this rifle to pick up the microscopic marks which are left on all cartridge cases fired in this weapon by the face of the bolt. Then those test cartridge cases were mounted on a comparison microscope, on the right hand side, and on the left hand side of the comparison microscope was mounted one of the three submitted cartridge cases, so that you could magnify the surfaces of the test and the evidence and compare the marks left on the cartridge cases

14 ajl by the bolt face and the firing pin of the rifle.

(At this point, Mr. McCloy left the hearing room.)

Mr. Eisenberg. I now hand you two cartridge cases and ask you whether you can identify these cartridge cases.

Mr. Frazier. Yes, sir. These are the two cartridge cases we fired for test purposes in Exhibit 139.

Mr. Eisenberg. Do they have any marks on them?

Mr. Frazier. Yes, they do.

Mr. Eisenberg. Commissioner Boggs, may I introduce these as 557?

Rep. Boggs. They may be admitted.

(The items referred to were marked Commission Exhibit 557 for identification and received in evidence.)

Mr. Eisenberg. These were the only two cartridge cases fired as tests in Exhibit 139 -- as tests for the purpose of identification of the cartridge cases which you have examined before, 543, 544, and 545?

Mr. Frazier. Yes, sir, these two were used in those tests. There were many other cartridge cases fired, but not for that purpose.

Mr. Eisenberg. Can you explain how you were able to come to a conclusion that a cartridge case was fired in a particular weapon to the exclusion of all other weapons?

Mr. Frazier. Yes, sir. During the manufacture of a weapon, there are certain things done to the mechanism of it, which ARE

15 ajl machine or by filing, by grinding, which form the parts of the weapon into ~~their~~ their final shape. These machining and grinding and filing operations will mark the metal with very fine scratches or turning marks ~~or~~ grinding marks in such a way that there will be developed on the surface of the metal a characteristic pattern. This pattern, because it is made by these accidental machine-type operations, will be characteristic of that particular weapon, and will not be reproduced on ~~separate~~ other weapons. It may be a combination of marks ~~that~~ -- the face of the bolt may be milled, then it may be in part filed to smooth off the corners, and then, as a final operation, it may be polished, or otherwise adjusted during the hand fitting operation, so that it does have its particular pattern of microscopic marks.

The bolt face of the 139 rifle I have photographed and enlarged in this photograph to show the types of marks I was referring to.

Mr. Eisenberg. You took this photograph yourself, and it is a photograph of the bolt face of the 139 rifle?

Mr. Frazier. Yes, sir.

Mr. Eisenberg. May I have this introduced as 558?

Rep. Boggs. It may be admitted.

(The photograph referred to was marked Commission Exhibit 558 for identification and received in evidence.)

Mr. Eisenberg. What is the magnification of this bolt face?

Mr. Frazier. Approximately -- 11 diameters.

Mr. Eisenberg. [illegible] the bolt of the rifle so we could see how it [illegible] us the part of the bolt which is photographed.

Mr. Frazier. Orienting the photograph with the writing at the bottom, orients the bolt also, as it comes out of the rifle -- with the slot shown as a groove on the bottom of the bolt. Then the extractor on the bolt is the area shown at the left side of the photograph, as you view it -- the actual bolt face itself is inset into the bolt below the surface of the extractor, and a supporting shoulder around it, and in the center, of course, is the firing pin hole and the firing pin.

The marks ~~placed~~ PRODUCED during manufacture are the marks SEEN ON ~~of~~ the bolt face; filing marks, machining marks of the various types, even forging marks or casting marks if the bolt happens to be forged or cast. And then variations which occur ~~in~~ IN these marks during the life of the weapon are very important in identification, because many of the machining marks can be flattened out, can be changed, by merely a grain of sand between the face of the cartridge case and the bolt at the time a shot is fired, which will itself scratch and dent the bolt face. So the bolt face will pick up a characteristic pattern of marks which are peculiar to it.

The same is true of extractors and ejectors. They are in turn machined and will have a pattern of marks or scratches on their surfaces which will mark cartridge cases in the same manner each time.

17 ajl

The comparison we made was of the marks appearing in this photograph 558, in the fairly close proximity to the firing pin hole, since that is the area that the primer in the head of the cartridge case comes in contact ~~with~~.

The primer in a cartridge case normally takes marks more readily than the surrounding brass portion of the cartridge case, which is ~~considerably harder~~ as a considerably harder metal and ~~does not~~ is not impressed with these marks as readily.

The three cartridge cases, 553, 554 and555, were compared --

Mr. Eisenberg. Is that 543, 544 and 545?

Mr. Frazier. I am sorry -- yes, 543, 544 and 545. These three cartridge cases were placed one at a time on the comparison microscope, and the surfaces of the breech face marks or the bolt marks were compared with those on the test cartridge cases, Exhibit 557. As a result of comparing the pattern of microscopic markings on the test cartridge cases and those marks on Exhibits 543, 544 and 545, both of the face of the bolt and the firing pin, I concluded that these three had been fired in this particular weapon.

Rep. Boggs. Who manufactured these cartridges?

Mr. Frazier. Western Cartridge Company, East Alton, Illinois.

Rep. Boggs. They manufacture cartridges and bullets for all manner of rifles?

Mr. Frazier. Yes, they do.

Rep. Boggs. This is not -- this rifle is not common in the

8 ajl

United States, is it?

Mr. Frazier. It is fairly common now, but at the time it was manufactured or used primarily it was not. It was imported into this country as surplus military equipment, and has been advertised quite widely.

Rep. Boggs. These three cartridge -- these three shells that you had were the same as the live ones that were found there, were they not?

Mr. Frazier. There was one live cartridge found. They are identical.

Rep. Boggs. I thought you said there were three others.

Mr. Eisenberg. Three shells and one live.

Rep. Boggs. I understand. No others.

Mr.Eisenberg. No, sir.

Rep. Boggs. And the live one was manufactured also by --

Mr. Frazier. Yes, the Western Cartridge Company. It bears the head stamp "WCC" and "6.5. ~~mm.~~ m/m."

Rep. Boggs. These are not difficult to obtain? You can buy them anywhere?

Mr. Frazier. Well, you can buy them from mail order houses primarily, or a few gun shops that have accumulated a supply by ordering them. The fact is that we have is that two million rounds were imported into the United States in one lot, one shipment, and THEY ~~have~~ ARE been transmitted over the country and ~~is~~ ARE for sale by several different surplus gun dealers and gun shops, mail order houses and

ajl places of that nature -- and gunsmiths, and firearms shops sell this ammunition.

Rep. Boggs. Go ahead.

Mr. Eisenberg. Mr. Frazier, what is the basis of the statement you made earlier that no two bolt faces would be the same?

Mr. Frazier. Because the marks which are placed on any bolt face are accidental in nature. That is, they are not placed there intentionally in the first place. They are residual to some machining operation, such as a milling machine, where each cutter of the milling tool cuts away a portion of the metal; then the next tooth comes along and cuts away a little more, and so on, until the final surface bears the combination of the various teeth of the milling cutter. In following that operation, then, the surface is additionally scratched until you have numerous -- we call them microscopic characteristics, a characteristic being a mark which is peculiar to a certain place on the bolt face, and of a certain shape. It is of a certain size. It has a certain contour. It may be just a little dimple in the metal or a spot of rust, at one time on the face of the bolt, or have occurred from some accidental means, such as dropping the bolt or repeated use, having flattened or smoothed off the surface of the metal.

Mr. Eisenberg. Why [illegible] of the same machines, or repeated use of the same [illegible] the same results, apart from future accidental [illegible].

Mr. Frazier. In a [illegible] certain type of cutter will

20 ajl duplicate a certain pattern of marks. In general you will find for a milling cutter a circular mark. And you may find the same pattern of circles. But that milling cutter does not actually cut the steel; it tears it out, it chips it out, and the surface of the metal then is rough -- even though the circle is there, the circle is not a smooth circle, but it is a result of tearing out the metal, and you will have a very rough surface. When magnified sufficiently, you can detect the difference even between two similarly milled surfaces because of the minor variations in the cutting operation.

Mr. Eisenberg. Have you had occasion to examine such similarly-milled surfaces?

Mr. Frazier. Oh, yes, many times.

Mr.Eisenberg. Would you go into detail on that?

Mr.Frazier. Well, part of my work in the laboratory is dealing with tool marks of all types, from drills, mills, files, cutting instruments and so on. And when you are dealing with filing marks or milling marks and so on, it is sometimes possible to identify a particular mill as having made a certain mark on the basis of the grinding marks on that particular mill. But such as a case like this, where the cutting marks have now been altered through use of the weapon and corrosion or in wear or in filing, some of the original marks are removed, and other marks are in their place, until eventually you reach a condition where that bolt face will be entirely different from any other bolt

face. It is a matter actually -- when you get down to the basis of it, it is a matter of a mathematical impossibility in the realm of human experience for any two things to ever be exactly alike.

Mr. Eisenberg. That is because the original markings will not be exactly alike, and then you have added accidental markings on top of the original ones?

Mr. Frazier. That is right, yes, sir.

Mr. Eisenberg. Returning for a moment to the original markings, as I understand it, you have worked with the tools themselves and the impressions the tools themselves leave as opposed to a tooled surface, which is this.

Mr. Frazier. I have worked with both. In other words, in comparing tool marks, you examine not only the tool, but the marks they produce.

Mr. Eisenberg. And in working with these tools, as I understand your testimony, you have found that the markings which a tool leaves, which the same tool leaves, will be distinctive.

Mr.Frazier. That is true, yes. When it is a scrape or an impression from its surface, or something of that nature, it can be very readily identified. But if it is a drill or something of that nature where you have a tearing operation, then it is not readily identified, but it occasionally can be identified.

Mr. Eisenberg. Well, how many such examinations do you think you have made?

Mr. Frazier. Thousands of them.

Mr. Eisenberg. But you noticed whether the marks left by a given tool change -- that you have examined -- change over the course of the use of the tool?

Mr. Frazier. Yes, they change very rapidly when a tool is used to cut a hard object.

Mr. Eisenberg. Could you elaborate on what you mean by "very rapidly"?

Mr. Frazier. Well, for instance, when using a pry bar, for example, one insertion of a pry bar into the hard insulation of a safe, with pressure applied to it can change the entire blade of the tool to the extent that you could not identify a succession of marks, because of the abrasion by the insulation. But that same tool, used to mark a soft steel or brass or copper, could make mark after mark without changing, or only a small portion of it may change with each impression. Ok it may gradually change over a period of time.

Mr. Eisenberg. Now, is the metal in the bolt face a hard metal or a soft metal?

Mr. Frazier. I would say it was hard metal--

Mr. Eisenberg. Well --

Mr. Frazier. With reference to copper or other softer metals- it is a steel. I could not say how hard it actually is.

Mr. Eisenberg. What will the effect of the metal used in the bolt face be upon the tool which is used to finish it off, cut it and finish it off?

:3 ajl

Mr. Frazier. The tool will gradually wear out.

Mr. Eisenberg. Well, will the tool leave different marks on the end of the bolt face from one bolt to the very next bolt face?

Mr. Frazier. Oh, yes. That very often happens. The tool is worn out or the small cuttings get underneath the edge, between the tool, and nick the edge of the tool, so that the tool will gradually change over a period of time. The cutting edge -- the amount of change depends upon the amount of wear, the heat involved and the hardness of the metal -- the relative hardness of the metal.

Mr. Eisenberg. Will that particular change be noticed invariably in two consecutive bolt faces?

Mr. Frazier. No, sir.

Mr. Eisenberg. Would be the genesis of the difference in the two consecutive bolt faces as they come from the manufacturer?

Mr. Frazier. The change, as I said, depends on the bolt you are using. It does not always take place, because some bolts are made of a very soft metal, and they will not necessarily change a machining tool to that extent.

Mr. Eisenberg. But the markings, you said, would be different on two consecutive bolt faces?

Mr. Frazier. Oh, yes.

Mr. Eisenberg. And if the tool is not changed, what is

the origin of the difference between the markings?

Mr. Frazier. There are other accidental markings placed there during the machining operation.

Mr. Eisenberg. Could you describe that?

Mr. Frazier. For instance, as the blade of a milling machine travels around a surface, it takes off actually a dust -- it is not actually a piece of metal -- it scrapes a little steel off in the form of a dust -- or a very fine powder or chip -- that tooth leaves a certain pattern of marks--that edge. That milling cutter may have a dozen of these edges on its surface, and each one takes a little more. Gradually you wear the metal down, you tear it out actually until you are at the proper depth. Those little pieces of metal, as they are traveling around, can also scratch the face of the bolt -- unless they are washed away. So that you may have accidental marks from that source, just in the machining operation.

Now, there are two types of marks produced in a cutting operation. One, from the main along the cutting edge of the tool, which produces by a circular operating tool -- which produces very fine scratches in a circular pattern. Each time the tool goes around, it erases those [illegible] are there before. And when the tool is finally [illegible] you have a series of marks which go around the surface [illegible] machined, and you will find that that pattern of [illegible] as the tool goes around, will [illegible]. In one area, it will be [illegible] of marks -- and as you [illegible]

examine the surface of the metal, these very fine marks will extend for a short distance then disappear, and a new mark of a new type will begin and extend for a short distance. The entire surface, then, will have a -- be composed of a series of circles, but the individual marks seen in the microscope will not be circular, will not form complete circles around the face of the bolt.

Mr.Eisenberg. Have you had occasion to examine two consecutive bolt faces from a factory?

Mr. Frazier. Oh, yes.

Mr. Eisenberg. And what did you find on that examination?

Mr. Frazier. There would be no similarity in the individual microscopic characteristics between the two bolt faces.

Mr. Eisenberg. There actually was none?

Mr. Frazier. No, there was none.

Mr. Eisenberg. In the bolt face with which we are dealing, Exhibit 139, can you say from inspection whether the markings on that bolt face are predominantly the accidental markings introduced subsequent to manufacture or the markings of the manufacturer?

Mr. Frazier. I would say that these were filing marks for the most part which were made during manufacture, some of which have been obliterated and changed through use -- possibly corrosion.

Mr. Eisenberg. Mr.Frazier, taking Exhibit 139, did you prepare a photograph of this exhibit?

Mr. Frazier. Yes, sir.

Mr. Eisenberg. Compared with the test cartridge case?

Mr. Frazier. Yes, sir. This is the photograph showing the test cartridge case from Exhibit 557 on the right, the cartridge case, 543, on the left.

Mr. Eisenberg. This was prepared by you or under your supervision?

Mr. Frazier. Yes, sir.

Mr. Eisenberg. Mr.Chairman?

Rep. Boggs. It may be admitted.

(The item referred to was marked Commission Exhibit 559 for identification and received in evidence.)

Mr. Eisenberg. Now, that is marked on the left C-14, and on the right, C-6.

Mr. Frazier. Yes, sir.

Mr. Eisenberg. And the left-hand photograph is a photograph of what?

Mr. Frazier. Of the cartridge case 543.

Mr.Eisenberg. That is the actual fired case?

Mr. Frazier.. Yes, sir. It shows just a portion of the primer, and a very small portion of the firing pin impression.

Mr. Eisenberg. And the right-hand side of that photograph, marked C-6?

Mr. Frazier. It is a test cartridge case, fired in the rifle Exhibit 139.

Mr.Eisenberg. What is the magnification, Mr. Frazier?

Mr. Frazier. Approximately 100 diameters.

Mr. Eisenberg. And is that magnification equal on both sides of the picture?

Mr. Frazier. Yes, sir.

Mr. Eisenberg. Did you make your identification of Exhibit 543, that is the identification of that exhibit, as having been fired in the rifle, 139, on the basis of your examination under the microscope, or on the basis of the photograph?

Mr. Frazier. Under the microscope. The photograph has no relationship whatsoever to the examination.

Mr. Eisenberg. Can you explain that?

Mr. Frazier. The examination is made microscopically through the use of your eyes, and your eyes will record depths and shapes to a much greater extent than can be shown in a photograph. So that the examination and comparison is made of these irregular surfaces mentally, rather than mechanically by any means. The photograph is taken primarily to illustrate the types of marks found and their location [illegible] the specimen.

Rep. Boggs. We will [illegible] and come back at two.

(Whereupon, at 12:[illegible] the hearing was recessed until 2:00 o'clock p.m. of the same day.)

AFTERNOON SESSION

2:10 p.m.

Mr. McCloy. You are still under oath, you know.

Mr. Frazier. Yes, sir.

Mr. Eisenberg. I would like to begin by clearing up a few items which have been covered or left open during the morning session.

First, you were going to supply us with certain figures concerning the times which were taken by two of the Agents to fire three shots in the first series of tests which were given for determining the accuracy of the firing under rapid-fire conditions.

TESTIMONY OF ROBERT A. FRAZIER (resumed)

Mr. Frazier. Yes, sir. That was at two targets. The first one I gave you Killin fired in nine seconds. The other one was a target marked Cunningham and Frazier. Cunningham fired his three shots in eight seconds and I fired my three shots in 5.9 seconds.

Mr. Eisenberg. Now also you had made certain calculations concerning what we have been calling the lead that had to be given to a target, assuming various factors which were supplied to you. Do you have those calculations now?

Mr. Frazier. Yes, sir. The lead would amount to shooting over the target at 175 feet of distance, of 6.7 inches, and the decimal on that figure is not an accurate decimal because this

figure relates to an average velocity of ammunition of this type, and is concerned with a speed of a vehicle which is also estimated and a distance which may or may not be exactly accurate.

But at a ground speed of 11 miles an hour, it would be necessary to shoot over or lead a target 6.7 inches for the bullet to hit the intended spot on the target. At 205 feet the lead would be .51 feet, or 6.1 inches.

I might say that the variation, that of less lead at the longer distance, is in great part due to the fact that the target is farther away and that the shot is more nearly in line with the direction in which the target is moving which would account for much of the drop in the amount of lead.

And, in addition, I calculated this on the basis of the fact that there was a slight slope between the 175 foot and the 205 foot location downwards away from the shooter, which would also tend to more nearly cause the target to be moving in the same path as the bullet.

Mr. Eisenberg. And did you convert those lead distances into the amount of inches which the shooter would have to sight above the head, above the point of the target?

Mr. Frazier. Those figures I gave were the elevations or the sighting distances above the target. The 6.7 inches vertical lead or sighting over the target is the equivalent of leading on the ground of 1.4 feet.

adds [Mr. Eisenberg. So when you made 6.7 [illegible]

inches?

Mr. Frazier. 6.7 inches, that is right. Did I say feet?

Mr.McCloy. You said feet, yes.

Mr. Frazier. I am very sorry if I did. It is 6.7 inches.

Mr. Eisenberg. And the other figure?

Mr. Frazier. The other figure -- I see where that came in. It is a [illegible] feet instead of the figure I gave you. In the first instance, it is 6.7 inches, and the second one is 6.1 inches.

Mr. Eisenberg. And that table also shows leads of other car speeds?

Mr. Frazier. This table -- I could calculate them -- it only shows miles per hour translated into feet per second.

Mr. Eisenberg. I mean does it show various miles per hour?

Mr. Frazier. Yes, it shows miles per hour in ~~an~~ feet per second.

Mr. Eisenberg. Without going into detail at this time, may I have permission to introduce this table into evidence?

Mr. McCloy. It may be admitted.

Mr. Eisenberg. This will be Commission Exhibit 560.

(The item identified as Commission Exhibit 560 was received in evidence.)

Mr. Eisenberg. Now, Mr. Frazier, in the construction of this table and also in your last tests for rapid five for this rifle, you used a five and a half second figure as a factor in

your calculations, or in your attempt at accuracy placements. Can you give us the source of that figure?

Mr. Frazier. Yes, sir. You were the source of it based on examination, as I understood it, of a movie taken at the scene, and measurements taken at the scene. However, I have no knowledge of the actual time.

Mr. Eisenberg. For the record, I just wanted to establish that this is a source that was supplied by the Commission and which is tentative, and it is not to imply any final conclusion on the part of the FBI; is that correct?

Mr. Frazier. I hope it is taken that way, because we don't know what the time actually was.

Mr. Eisenberg. Another point then which should havebeen covered this morning, Mr. Frazier, in your qualifications -- have you testified before in court?

Mr. Frazier. Yes, I have.

Mr. Eisenberg. Can you estimate the number of times?

Mr. Frazier. Approximately 400 times.

Mr. Eisenberg. Finally, we had discussed briefly your examination of consecutively manufactured bolt faces to see whether any two such consecutively manufactured bolt faces were identical in their microscopic characteristics. How many such examinations have you performed.

Mr. Frazier. I [illegible] examinations of pairs of bolt faces which have been consecutively manufactured.

Mr. Eisenberg. And in each case the result was what?

Mr. Frazier. The marks on one bolt face in no way ~~[illegible]~~ ~~[illegible]~~ represented"is not the word -- "resemblen" ~~[illegible]~~ resembled the marks on the other bolt face.

Mr.Eisenberg. Mr.Frazier, we were just beginning to discuss, before the recess, Commission Exhibit 559, which is a picture as you described it of Exhibit No. 543, and a test cartridge under a microscope, and that is also known as C-6 and C-14, is that right?

Mr.Frazier. Yes, sir.

Mr. Eisenberg. Could you discuss by using that picture some of the markingswhich you have seen under the microscope and on the basis of which you made your identification?

Mr. Frazier. Yes, sir. In the photograph I have drawn some small circles and numbered them, those circles, correspondingly on each side of the photograph. The purpose of the circles is not to point out all the similarities, but to call attention to some of them and to help orient in locating a mark on one with a mark on the opposite side of the photograph. In general the area shown is immediately outside of the firing pin in the bolt of the 139 rifle, on the left side of the photograph, and Commission Exhibit 543 on the right side.

The circles have been drawn around the dents or irregularly shaped ridges, small bumps, [illegible] in the surface of the metal

in six places on each [illegible] photograph. It is an examination of these marks, and [illegible] of the marks on the face of the bullet microscopically which provides a conclusion to be reached. The photograph itself actually is a substitute to show only the type of marks found rather than their nature, that is, their height, their width, or their relationship to each other, which is actually a mental, visual, comparison on the two specimens themselves.

Mr. Eisenberg. Referring for a second to this mental, visual, comparison, Mr. Frazier, would a person without firearms training, firearms identification training, be able to look under a microscope and make a determination for himself concerning whether a given cartridge case had been fired in a given weapon?

Mr. Frazier. In that connection that person could look through the microscope. He may or may not see those individual characteristics which are present because he does not know what to look for in the first place, and, secondly, they are of such a nature that you have to mentally sort them out in your mind going back and forth between one area and the other until you form a mental picture of [illegible] in a comparison such as this.

If it was a different type of comparison, of parallel marks or something of that nature, then he could see the marks, but in either instance, without having compared hundreds and hundreds of specimens, he would not be able to make any statement as to whether or not they were fired from the same rifle.

Mr. Eisenberg. Would you say that this is then a matter of

expert interpretation rather than a point for point comparison which a layman could make?

Mr. Frazier. I would say so, yes. But I don't think a layman would recognize some of the things on these cartridge cases and some shown in the photographs as actually being significant or not significant, because there will be things present which have nothing whatsoever to do with the firing of the cartridge case in the gun.

There may be a depression in the primer to begin with, and there are no marks registered at that point as a result of the firing. Unless these things are known to occur, someone may actually arrive at a different conclusion, because of the absence of similar marks.

Mr. Eisenberg. Now having reference to the specific exhibit before you, which is 559 --

Mr.Frazier. Yes.

Mr. Eisenberg. Are all the marks shown in both photographs identical?

Mr. Frazier. No.

Mr. Eisenberg. Are you able to go into detail on a mark which is not identical to enable you to find out why you did get such a result?

Mr.Frazier. Well [illegible] between that I have drawn here as circle 4 and [illegible] is a slanting line from the [illegible] left to the [illegible] this line there [illegible] line in the photograph.

On the other side there is a rough, very rough ridge which runs through there, having an entirely different appearance than the relatively sharp line on C-6. The significant part of that mark is the groove in between rather than the sharp edge of the mark, because the sharp corner could be affected by the hardness of the metal or the irregular surface of the primer and the amount of pressure exerted against it pressing it back against the face of the bolt at the time the cartridges were fired. So that you would never expect all the marks on one cartridge case to be identical with all the marks on the other cartridge case.

In fact, you would expect many differences. But the comparison is made on the overall pattern, contour and nature of the marks that are present.

Mr. Eisenberg. Off the record.

(Discussion off the record.)

Mr. Eisenberg. Back on the record.

Mr. Frazier, could you discuss or characterize those points which you have circled on Commission Exhibit 559 starting from the top?

Mr. Frazier. Number 1 circle is drawn around a depression in the metal of irregular shape. I might say that number 1 shows on the right side of the photograph, and only half of it shows on the left side because of the relative position of the two cartridge cases in the photograph.

Number 2 is a circle drawn around a long line which cuts