
REPORT OF THE
FIREARMS PANEL

Select Committee on Assassinations
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INTRODUCTION*

(1) From the outset, the Kennedy assassination task force of the Select Committee on Assassinations believed that a complete scientific examination of all firearms evidence** was essential to its investigation. The committee wanted to address the many questions that had arisen over the last 15 years about the firearms and firearms identification in the cases of President Kennedy, Dallas Police Officer J. D. Tippit, and Lee Harvey Oswald. The primary concern was to conduct a thorough examination of all the evidence, though some items, such as Jack Ruby's revolver, were less relevant. The committee chose this approach in part to see if any new investigative leads would develop.

Background

(2) Within an hour after President Kennedy was shot at approximately 1:12 p.m. central standard time (CST) (1) on November 22, 1963, Deputy Sheriff Luke Mooney discovered three expended cartridge cases on the floor near a window at the southeast corner of the sixth floor of the Texas School Book Depository. (2) The cartridge cases were turned over to the FBI on November 23, 1963. (3)

(3) At 1:22 p.m., (4) Deputy Sheriff Eugene Boone and Deputy Constable Seymour Weitzman discovered a bolt-action rifle equipped with a telescopic sight, also on the floor of the sixth floor of the book depository, but near the northwest corner. (5) Neither handled the rifle, but at the time Weitzman described it as a 7.65-millimeter caliber German Mauser. (6) (It was subsequently determined to be a 6.5-millimeter caliber Mannlicher-Carcano Italian military rifle. (7)) It was removed from the depository by Lieutenant Day and remained in his possession until it was released to the FBI at 11:45 p.m., November 22, 1963. (8)

(4) When found, the Mannlicher-Carcano contained one unfired 6.5-millimeter caliber copper-jacketed, military-type cartridge, manufactured by the Western Cartridge Co. The cartridge was removed from the rifle by Capt. J. Will Fritz where the rifle was found. (9)

(5) Later that day, the rifle's six-round cartridge clip was removed by Lieutenant Day in the Dallas Police Crime Laboratory. (10)

(6) While the officers were collecting evidence in the book depository, Officer J. D. Tippit was shot and killed in the Oak Cliff section of Dallas several miles away. (11) Four expended .38 special caliber cartridge cases were found at the scene of the murder. (12) Two of the recovered cartridge cases were manufactured by the Western Cartridge Co., the other two by Remington-Peters. (13) All four were delivered to the FBI laboratory on November 30, 1963. (14) Four .38

*Materials submitted for this report by the firearms panel were compiled by HSCA staff members Jim Conzelman and Whitney Watriss.

**A glossary of technical terms can be found at the end of this report.

special caliber bullets were later removed from Tippit's body during his autopsy. They were given to the FBI laboratory on March 16, 1964.(15)

(7) Lee Harvey Oswald was arrested as a suspect in the Tippit shooting shortly before 2 p.m.,(16) November 22. Apprehended after a scuffle in the Texas theater, he was carrying a Smith and Wesson revolver modified to fire .38 special caliber ammunition.(17) Four cartridges were found in the cylinder of the revolver and turned over to the FBI laboratory by the Dallas police on November 30, 1963.(18) Two cartridges were found to be of Western Cartridge Co. manufacture, two of Remington-Peters.(19) Five Western .38 special caliber cartridges were found in Oswald's trouser pocket and also were given to the FBI laboratory by the Dallas police on November 30, 1963.(20)

(8) At approximately 1:55 p.m.(21) on November 22, a virtually intact bullet was found on a stretcher in the emergency area of Parkland Memorial Hospital by Nathan Burgess Pool, an employee of Otis Elevator Co., and D. C. Tomlinson, power plant engineer of Parkland Hospital.(22) Tomlinson handed the bullet to a Secret Service agent standing by the door to the emergency entrance.(23) The bullet was delivered to the FBI laboratory in Washington, D.C., that same day.(24) The Warren Commission eventually designated this bullet Commission exhibit 399 (CE 399), and concluded that it had caused all of Governor Connally's wounds after passing through the President's neck.(25)

(9) Other items of evidence were later recovered. Four lead-like fragments were removed from Governor Connally's wrist (26) and delivered to the FBI laboratory on November 23, 1963.(27) During the President's autopsy at Bethesda Naval Hospital, three fragments were removed from his brain; (28) they were subsequently delivered to the FBI laboratory on November 23, 1963.(29) Four more fragments were recovered from the Presidential limousine: the nose portion of a metal-jacketed bullet, found on the right side of the front seat by the Secret Service; (30) the base portion of a metal-jacketed bullet, found on the floor next to the right front seat by the Secret Service; (31) two lead-like fragments found on the rug underneath the left jump seat by the FBI; (32) and lead residue taken from the inside of the windshield by the FBI.(33) This evidence was turned over to the FBI laboratory for analysis on November 22, 1963.(34)

(10) In addition to these other items, the Warren Commission obtained the bullet recovered by the Dallas police after an attempted assault on General Walker in Dallas on April 10, 1963.(35) It was delivered to the FBI laboratory on December 4, 1963, for analysis.(36) Although the Commission concluded that Oswald fired the bullet, the FBI laboratory could not conclusively identify it with the Mannlicher-Carcano rifle.

(11) An item of evidence that the Warren Commission did not consider was the .38 special caliber Colt Cobra revolver recovered from Jack Ruby at the time of his apprehension in the basement of the Dallas Police Department by Detective L. C. Graves.(37) The revolver had never been sent to the FBI laboratory, but had remained in the possession of Dallas District Attorney Henry Wade, pending

Jack Ruby's trial. (38) At the conclusion of the trial, the revolver was given to the administrator of Jack Ruby's estate, Jules Mayer, (39) from whom the select committee obtained it.

(12) The whereabouts of the expended cartridge case found in the Ruby revolver and the bullet removed from Lee Harvey Oswald at his autopsy are unknown. According to William Alexander, assistant district attorney for the city of Dallas, the cartridge case and bullet were presented as evidence at Jack Ruby's trial; their disposition by the court is unknown. (40) The committee contacted the Dallas Police Department and Jules Mayer to locate them, but to no avail.

(13) The Warren Commission relied on FBI facilities for the firearms identification. (41) It concluded from the FBI tests that the stretcher bullet and the larger fragments of the base and nose of the bullet found in the limousine had been fired from the Mannlicher-Carcano rifle recovered from the Texas School Book Depository. (42) The remaining fragments removed from the limousine, Governor Connally's arm and President Kennedy's brain were too minute for any type of microscopical examination. Spectrographic and neutron activation analysis were conducted on all fragments, allowing their elemental composition to be compared. Although they were found to be of similar metallic composition, (43) the FBI laboratory was unable to determine whether the nose and base fragments originated from the same or different bullets. (44) The firearms examination also revealed that the three expended cartridge cases found in the book depository had been fired in the Mannlicher-Carcano rifle. (45)

(14) Regarding the bullet fired at General Walker, the FBI was unable to identify it with the rifle found on the sixth floor of the depository due to its mutilated condition, (46) although it had the same physical characteristics as the bullet of the cartridge found in the chamber of the Mannlicher-Carcano rifle and other Mannlicher-Carcano ammunition. (47)

(15) Regarding the evidence from the Tippit shooting, the bullets removed from the officer's body could not be positively identified with Oswald's revolver. (48) The FBI firearm experts found that the characteristics engraved on the bullets fired by the revolver were erratic. (49) The FBI experts were unable to identify a correspondence among their own test-fired bullets, even though they were documented as being fired from the same revolver. (50) The cartridge cases found near Tippit's body were, however, identified as having been fired in Oswald's revolver. (51)

(16) All exhibits, with the exception of the items relating to the Oswald shooting death, were given to the National Archives, from which the select committee obtained them.

(17) Two additional items, unavailable to the Warren Commission, were considered by the committee as possibly relevant to its inquiry. The first was a bullet fragment found in 1974 near the triple overpass in Dealey Plaza by Richard Lester. (52) Lester turned it over to the FBI on December 1, 1976, requesting that an analysis be conducted to determine if it might be connected with the assassination. (53) The FBI laboratory obtained from the National Archives the bullets test-fired in the Mannlicher-Carcano rifle in 1963, and on July 28, 1977,

examined the bullet fragment and compared it to the Mannlicher-Carcano test-fired bullets.(54) The laboratory determined that both the Lester bullet and the test-fired bullets were 6.5 millimeter caliber, but the Lester bullet was found to be a jacketed, softpoint or jacketed, hollow-point sporting bullet, whereas the Mannlicher-Carcano bullet was to be a full metal-jacketed, military-type. Although the rifling impressions were similar, four lands and grooves, right twist, the widths of the land and groove impressions were found to vary by about 0.01 inch. The individual identifying characteristics were found to be different. Thus, the laboratory concluded that there was no indication the Lester bullet had been fired from the Mannlicher-Carcano rifle.(55) The laboratory returned the test-fired bullets to the Archives(56) and the fragment to Lester at the completion of its examination.(57) The select committee obtained the bullet from Lester on November 10, 1977.(58)

(18) The second item of evidence was a bullet fragment found in 1967 by Rich Haythorne, who was working as a roofer on top of the Massey Roofing Co. building in the 1200 block of Elm Street, about eight blocks from the Texas School Book Depository(59) (the building is no longer there). It had remained in the possession of Haythorne's attorney, Bill Mason, until he sent it to the committee on April 20, 1977.(60)

(19) Critics of the Warren Commission have used the firearms evidence to cast doubt on its conclusions. Illustrative of the issues that have been raised are the following:

(20) Edward J. Epstein, in "Inquest", contends that more bullet fragments were found in Governor Connally's body than could have been left by the CE-399 bullet that the Commission concluded caused all his wounds.(61)

(21) Mark Lane, in "Rush to Judgment," and others claim that the CE-399 bullet could not have remained virtually intact after causing the Governor's many severe wounds.(62)

(22) In "They've Killed the President," Robert Sam Anson contends that the telescopic sight on the Mannlicher-Carcano rifle was mounted for a left-handed person.(63) Since Oswald is right-handed, it is doubtful that he could have fired the shots in the requisite amount of time.(64)

(23) Sylvia Meagher, in "Accessories After the Fact," questioned Oswald's ability to fire the Mannlicher-Carcano accurately because of the rifle's "hair trigger."(65) She cited the testimony before the Warren Commission of Ronald Simmons of the Ballistics Research Laboratory, Department of the Army, that it was difficult for experts when test-firing the rifle to become accustomed to the drag in the trigger.(66)

(24) Josiah Thompson, in "Six Seconds in Dallas," questioned whether the cartridge cases recovered on the sixth floor of the depository were in fact fired in the Mannlicher-Carcano.(67) He alleged that two of the cartridge cases had markings indicating that they had been loaded into a weapon at least twice—and not necessarily into the Mannlicher-Carcano. He further claimed that the third cartridge case was dented such that it could never have been fired in any rifle.(68)

(25) Finally, some critics, including Mark Lane, were suspicious because of Weitzman's initial misidentification of the Mannlicher-Carcano rifle as a 7.65-millimeter caliber German Mauser.⁽⁶⁹⁾

(26) In light of the criticisms of the Warren Commission's treatment of the firearms evidence, such as those mentioned above, and as part of its obligation to investigate fully the events surrounding President Kennedy's assassination, the select committee decided to convene a panel of experts to reexamine the firearms evidence.

Selection of the Panel

(27) In April 1977, the select committee sought recommendations for membership for the panel from the Association of Firearm and Tool Mark Examiners, the Forensic Science Foundation and the American Academy of Forensic Sciences. Candidates were to be leading firearms experts who had had no prior affiliation with either the King or the Kennedy assassination cases.*

(29) A list of 27 experts was proposed. Five were eliminated initially: three were current or past employees of the FBI; one had authored material on the firearms evidence; and one was unable to undertake the project.

(30) The remaining 22 prospects were asked to submit resumes, with information on past affiliations with the case and opinions about the assassination or the firearms evidence. Eighteen responded, 10 of whom did not want to be considered or did not meet the committee's criteria.

(31) The following five experts were chosen to serve on the panel:

(32) *John S. Bates, Jr.*—Senior firearms examiner in the New York State Police Laboratory at Albany. He has been a lecturer at the New York State Police Academy, New York State Municipal Police Training Council, and various community colleges.

(33) Bates is a member of the Association of Firearm and Tool Mark Examiners, serving as secretary since 1973. In that year, he received the association's Distinguished Member Award. He has written numerous professional articles.

(34) *Donald E. Champagne.*—Firearm and tool mark examiner with the Florida Department of Criminal Law Enforcement in Tallahassee for the past 10 years. He served in the crime detection laboratory of the Royal Canadian Mounted Police in Ottawa, Ontario, for 15 years, and he has lectured extensively at the Canadian Police College and other law enforcement agencies.

(35) Champagne is president and a distinguished member of the Association of Firearm and Tool Mark Examiners. He is a member of the Southern Association of Forensic Scientists and the Canadian Society of Forensic Science.

(36) *Monty C. Lutz.*—Firearm and tool mark analyst with the Wisconsin Regional Crime Laboratory in New Berlin. He has been the chief firearm and tool mark examiner for the U.S. Army.

(37) Lutz is a past president of the Association of Firearm and Tool Mark Examiners. He has been named a distinguished member of the

*The same panel members were also to examine the firearms evidence in the King assassination case.

association. He has lectured at colleges and law enforcement schools across the country and is the author of numerous professional publications. He received a B.S. in criminal justice from the University of Nebraska.

(38) *Andrew M. Newquist*.—Special agent and firearm, tool mark and latent fingerprint examiner for the Iowa Bureau of Criminal Investigation.

(39) Newquist is a distinguished member and past president of the Association of Firearm and Tool Mark Examiners and currently serves on its executive committee. He is a member of the International Association for Identification and a lecturer at the Iowa Department of Public Safety.

(40) The panel conducted its examination at the facilities of the Metropolitan Police Department firearm identification section, Washington, D.C. Assigned as liaison to the panel and working closely with it as technical assistant was George R. Wilson, senior firearms examiner, Metropolitan Police Department, Washington, D.C., a position he has held for 9 years. The laboratory, which he established, was the first in the department's history.

(41) Wilson is second vice president of the Association of Firearm and Tool Mark Examiners. In 1974, he received the association's Distinguished Member Award. During his 25-year tenure with the Metropolitan Police Department, he has been awarded over 30 commendations for outstanding and meritorious performance of duty.

(42) Photographic services were provided by police photographer Gary R. Phillips of the Metropolitan Police Department's photographic services section.

The issues addressed

(43) The panel was asked to address a number of issues concerning three categories of firearms evidence:

(44) —That relating to the shooting of President Kennedy and Governor Connally, which includes the Walker bullet and the bullet found in 1974 by Richard Lester;

(45) —That relating to the shooting of Tippit; and

(46) —The Ruby revolver (the bullet that killed Oswald and the expended cartridge case were not located).

The issues were as follows: In the Kennedy case:

(47) —Was the cartridge reportedly found in the Mannlicher-Carcano rifle in fact loaded into that rifle?

(48) —From which direction was the impact which damaged the windshield of the Presidential limousine?

(49) —Were the three expended cartridge cases found on the sixth floor of the Texas School Book Depository fired in the Mannlicher-Carcano rifle?

(50) —Was the bullet found at Parkland Hospital fired from the Mannlicher-Carcano rifle?

(51) —Was the bullet nose portion found on the right side of the front seat of the Presidential limousine fired from the Mannlicher-Carcano rifle?

(52) —Was the bullet base portion found on the floor beside the right front seat of the Presidential limousine fired from the Mannlicher-Carcano rifle?

(53) —Were the bullet nose portion and the bullet base portion found in the Presidential limousine components of the same bullet?

(54) —Was the bullet recovered from the residence of General Walker fired from the Mannlicher-Carcano rifle?

(55) —What are the nature and characteristics of the 6.5 millimeter caliber Mannlicher-Carcano rifle and ammunition with respect to power and impact?

(56) —Could the Mannlicher-Carcano rifle have been fired with a high degree of accuracy even though it has been described as having a "hair trigger"?

(57) —Would the dent on the mouth of one of the three expended cartridge cases found on the sixth floor of the Texas School Book Depository prevent the bullet from being fired in the Mannlicher-Carcano rifle, or any other rifle? Can it be determined whether these cartridge cases had been chambered on more than one occasion?

(58) —Does the method of mounting a scope on a rifle affect or have any influence on whether the rifle can be fired by a left-handed individual?

(59) —The Warren Commission found that the stretcher bullet weighed 158.6 grains when recovered and assumed its original weight before firing to have been 160-161 grains. Is it possible that the bullet sustained a weight loss of only 1.4 to 2.4 grains during the wounding of President Kennedy and Governor Connally?

(60) —Could a 6.5-millimeter caliber Mannlicher-Carcano rifle be easily mistaken for a 7.65-millimeter caliber German Mauser rifle? What are the obvious differing characteristics, if any?

(61) —Was the bullet found in 1974 by Richard Lester near the Texas School Book Depository fired from the Mannlicher-Carcano rifle?

(62) —Could the iron sights found on the Mannlicher-Carcano rifle be used with a high degree of accuracy and operability, as compared with the telescopic sight?

(63) —Do rifles using smokeless powder emit smoke discernible to the eye when fired?

(64) The issues the committee asked the panel to address in the Tippitt shooting were as follows:

(65) —What are the dimensional differences between a .38 S. & W. caliber cartridge and a .38 special caliber cartridge? Can a .38 special caliber cartridge be inserted in a weapon chambered for a .38 S. & W. caliber cartridge? Would this cause the side of the cartridge case to split, as happened with one of the cartridge cases test-fired by the FBI in Oswald's revolver?

(66) —Were the four cartridge cases recovered from the scene of the Tippit murder fired in the revolver recovered from Oswald when apprehended?

(67) —Were the four bullets recovered from Officer Tippit's body fired from the revolver recovered from Oswald when apprehended?

(68) —Of the four expended cartridge cases found at the scene of the Tippit murder, two were of Western Cartridge Co. manufacture, two of Remington-Peters. The autopsy of Tippit, however, revealed three bullets of Western Cartridge Co. manufacture and one of Remington-Peters. Can the panel formulate an opinion about this dis-

crepancy? Is it possible to determine which bullet came from each particular cartridge case?

(69) The issues the committee asked the panel to address in the Oswald shooting were as follows:

(70) —Are there any characteristics which are easily identifiable of Jack Ruby's revolver? Does it have a "hair trigger"?

(71) —What can the panel determine from an examination of the Ruby evidence?

(72) During the course of its investigation but after the panel had completed its work in Washington, D.C., the committee obtained a bullet which had been found in 1967, by Rich Haythorne on top of the Massey Roofing Co. building in Dallas. The committee asked George R. Wilson, the panel's technical assistant who was with the police department in Washington, D.C., to determine if the Haythorne bullet had been fired from the Mannlicher-Carcano rifle.

(73) Wilson described the bullet as jacketed, soft-point and .30 caliber; its class characteristics were six lands and six grooves, right twist. The bullet weighed 149.3 grains. It was consistent with Remington-Peters ammunition.

(74) Wilson concluded that the physical characteristics of the bullet were different from those of Mannlicher-Carcano ammunition, as well as from the rifling characteristics of the Mannlicher-Carcano rifle. Therefore, the bullet definitely was not Mannlicher-Carcano ammunition and was not fired from the Mannlicher-Carcano rifle.

Procedures and equipment

(75) The panel conducted its examination at the firearm identification section of the Washington, D.C. Metropolitan Police Department. These facilities were conveniently located to the National Archives and the select committee's offices, and they were made available by Police Chief Maurice J. Cullinane and firearms section supervisor George R. Wilson.

(76) The firearms panel met on November 12, 1977, at the National Archives to conduct a cursory examination of the evidence stored there. On January 30, 1968, the panel and its technical assistant met with representatives of the select committee at the Washington, D.C., Metropolitan Police Department firearm identification section. The following procedures were adopted at that time:

(77) —The panel members would jointly conduct visual and microscopical examinations of the evidence in the possession of the select committee and the National Archives. Each examiner would submit an independent worksheet to the select committee on each item of evidence examined.

(78) —The panel would jointly determine the operability of the Mannlicher-Carcano rifle, the Oswald revolver and the Ruby revolver. Each firearm would be test fired to obtain bullets and cartridge cases for comparison purposes.

(79) —A joint firearms panel report would be submitted to the select committee at the completion of all examinations.

(80) The panel was to conduct visual and microscopical examinations, as necessary, on each item of evidence. A summary of general principles follows.

(81) A cartridge, or round of ammunition, consists of a cartridge case, primer, powder and bullet. The primer contains a detonable mixture and fits into the base of the cartridge case, which contains powder. The bullet, constructed of lead or a lead core encased in a stronger metal jacket, fits into the mouth of the cartridge case. A bullet is fired by placing the cartridge in the chamber of a firearm. The cartridge base rests against a solid support, called a breech or bolt face. When the trigger is pulled, the firing pin strikes the primer, igniting the detonable mixture, which in turn ignites the powder in the cartridge case. The combustion propels the bullet through the barrel.

(82) The bore (inside of the barrel) of modern firearms is "rifled" with spiral grooves in it to give bullets fired through it a spinning motion for flight stability. The raised portions between the grooves are called lands. The number, width and direction of twist of the lands and grooves are called the class characteristics of a barrel.

(83) In addition to the class characteristics, the components of every firearm, such as the barrel, firing pin and breech face, bear distinctive microscopic characteristics. While the class characteristics are common to all firearms of a given model and manufacture, an individual firearm's microscopic characteristics differ from all other firearms, regardless of model or manufacture. These distinctive markings, usually referred to as individual identifying characteristics, are produced initially by the manufacturing tools, which change microscopically during operation and vary from one firearm to another. Further individual identifying characteristics are produced as the firearm is used, during its disuse, and as a consequence of maintenance or the lack of it.

(84) When a firearm is discharged, the individual identifying characteristics of its barrel, as well as its class characteristics, are engraved on the bearing surface of the bullet. The individual identifying characteristics of the firing pin and breech or bolt face are impressed on the base or primer of the cartridge case at the time of firing. Using a comparison microscope, an expert can compare the markings with those produced on a similar cartridge test-fired in the same firearm. If the patterns of the microscopic markings are sufficiently similar, it can be concluded that both cartridge cases were fired in the same firearm. Microscopical examination of other firearm components and the markings they produce may also demonstrate such things as whether a cartridge was ever loaded into a particular firearm or was loaded into a firearm more than once. It is also possible, through comparative microscopical examinations, to determine whether two bullets were fired from the same firearm.

(85) In its examinations, the panel used the following equipment:

- (86) —Two American Optical forensic comparison microscopes, model K1453, serial Nos. 328 and 277, with fluorescent and incandescent lighting, fiber optics, photographic unit and 10X eyepieces and objectives. One had a combined magnification of 12X, 20X, and 40X, the other 20X, 40X, and 80X.
- (87) —American optical low power binocular microscope with a zoom lens of 0.7 to 3 power and 10X eyepiece.
- (88) —Mico model 5100 balance with a 1,000-grain capacity.
- (89) —Sliccomb "Speedmike" direct readout micrometer.
- (90) —Brown and Sharpe stage micrometer for air gap measuring.

- (91) —Horizontal water recovery tank.
- (92) —Horizontal cotton waste recovery box.
- (93) —6.5-millimeter caliber Mannlicher-Carcano cartridges with full metal-jacketed bullets of Western Cartridge Co. manufacture. These were test fired by the panel in CE 139 and designated panel Kennedy T-1—T-4. (See Figs. 1 and 2.)
- (94) Additional 6.5-millimeter caliber Mannlicher-Carcano cartridges were used, unfired, for loading and unloading in the rifle to obtain class and individual identifying characteristics produced in that process.
- (95) Strict security measures were observed throughout the examinations. Public access to the firearms evidence at the National Archives was denied during this time. (70) A member of the Archives staff accompanied the evidence while it was examined at the Archives or removed and examined at the laboratory. The panel's materials—photographs, photomicrographs, test-fired bullets and cartridge cases—were secured in a safe in the firearm identification section at the District of Columbia Metropolitan Police Department.

FINDINGS AND CONCLUSIONS OF THE FIREARMS PANEL CONCERNING THE KENNEDY ASSASSINATION

(96) The findings and conclusions were prepared by staff of the House Select Committee on Assassinations based on material submitted by the panel members. The panel has read and accepts those findings and conclusions.

KENNEDY SHOOTING

Evidence examined

(97) The following evidence was examined in connection with the shooting of President Kennedy.

(98) CE 139(71)—One 6.5-millimeter caliber, bolt-action repeating rifle, Mannlicher-Carcano Model 1938, serial number C2766. Attached was an Ordnance Optics, Inc. 4X telescopic sight and an adjustable black leather strap.* (See figs. 3A and 3B.)

(100) A visual examination of the rifle revealed pitting, rust and copper oxidation to test-firing, which the panel believed should be removed prior to test-firing. Accordingly, a dry cloth patch was pushed through the bore.

(101) The telescopic sight was attached to a mount, which itself was attached to the left side of the rifle. Mounting facilities were not provided at the time of manufacture. Also attached to the rifle were standard iron sights, placed on the rifle at the time of manufacture.

(102) The rifle was test-fired by all panel members, using 6.5-millimeter caliber ammunition of Western Cartridge Co. manufacture. Two bullets were test-fired into a horizontal water recovery tank. Further tests were conducted by loading four cartridges into the CE 375 cartridge clip and inserting it into the magazine of the rifle. The cartridges were worked through the rifle's mechanism and ejected without being fired. When the last cartridge was chambered, the cartridge clip remained in the magazine instead of falling out as it is designed to do.

(103) CE 141.—One 6.5-millimeter caliber cartridge of Western Cartridge Co. manufacture, found in the CE 139 rifle. (See fig. 4.)

(104) CE 351.—One damaged automobile windshield removed from the Presidential limousine. (See fig. 5.)

(105) CE 399.—One fired 6.5-millimeter caliber full metal-jacketed bullet, found on a stretcher in the emergency area of Parkland Hospital. The bullet weight was found to be 157.7 grains. (72) In the same box as the bullet was a tiny fragment, which was too small to weigh or otherwise examine. (See figs. 6A and 6B.)

*The CE 139 rifle was physically examined and found to be operable. It had not been properly cleaned, maintained or lubricated. The rifling of the barrel was four lands and four grooves, right twist. The magazine was a non-detachable box, clip-fed type, with a 6-cartridge capacity. The trigger pull was determined by the panel to be approximately 3 pounds.

(106) *CE 542*.—One 6.5-millimeter caliber, bolt-action repeating rifle, Mannlicher-Carcano model 1938, serial No. UC5209. Attached was 4 × Ordnance Optics, Inc., telescopic sight and an adjustable black leather strap. The strap is consistent in length, design, and construction with the strap on the CE 139 rifle. The rifle was purchased by the FBI in order to compare the method of mounting the telescopic sight. (See fig. 7.)

(107) *CE 543*.—One expended caliber 6.5-millimeter cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See figs. 8A and 8B.)

(108) *CE 544*.—One expended 6.5-millimeter caliber cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See fig. 9.)

(109) *CE 545*.—One expended 6.5-millimeter caliber cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See fig. 10.)

(110) *CE 557*.—Two expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, test-fired by the FBI laboratory in the CE 139 rifle for purposes of comparison with CE 543, CE 544, and CE 545. (See Warren Commission hearings, vol. 17, p. 249.)

(111) *CE 567*.—The nose portion of a 6.5-millimeter caliber metal-jacketed bullet found on the right side of the front seat of the Presidential limousine. (See fig. 11.)

(112) *CE 569*.—The base portion of a metal-jacketed bullet found on the floor beside the right side of the front seat of the Presidential limousine. (See fig. 12.)

(113) *CE 572*.—Two fired 6.5-millimeter caliber full metal-jacketed bullets, test-fired by the FBI from the CE 139 rifle and designated as K1A and K1B*. (See fig. 13.)

(114) *CE 573*.—One 6.5 millimeter caliber metal-jacketed bullet recovered from the residence of General Walker in April 1963 after an attempted assault. (See fig. 14.)

(115) *CE 575*.—One brass cartridge clip with a six-cartridge capacity, stamped "SMI 952," removed from the CE 139 rifle. (See fig. 15.)

(117) *CE 840*.—Two lead-like fragments** recovered from the rug underneath or in the area which was underneath the left jump seat of the Presidential limousine. (73) The panel found that each fragment weighed 0.5 grain. Because of their minute size, no further examinations were conducted on this exhibit. (See fig. 16.)

(118) *CE 841*.—One round metal box containing lead residue recovered by the FBI from the inside surface of the windshield of the Presidential limousine. Because of the small size of the sample, further examinations were not conducted. (See hearings before the Warren Commission, vol. 17, p. 840.)

*The two test-fired bullets were used as standards for comparison with the class characteristics on CE 399, found on a stretcher at Parkland; with those on CE 567, the bullet nose portion found in the limousine; and with CE 569, the bullet base portion found in the limousine.

**The FBI originally recovered three particles. In 1970, an independent researcher brought to the attention of the National Archives that one of the three fragments was missing. The Archives has been unable to locate it.

(119) *CE 842*.—Four lead-like fragments. The smallest was identified as having come from Governor Connally's arm. The panel found that the largest fragment weighed 0.3 grain. The other fragments were too small to weigh. Because of the small size of the fragments, no further examinations were conducted on this exhibit. (See fig. 17).

(121) *CE 843*.—Three lead-like fragments removed from President Kennedy's brain during the autopsy. The largest weighs 0.6 grain; their combined weight is 0.7 grain. Because of the small size of the fragments, no examinations were conducted on this exhibit. (See fig. 18.)

(122) *CE 853*.—One fired 6.5-millimeter caliber full metal-jacketed bullet, fired through a goat at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration and its subsequent loss of velocity. The panel found that fruitful examination of this bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 819.)

(123) *CE 856*.—One fired 6.5-millimeter caliber full metal-jacketed bullet, test-fired through a cadaver's wrist at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration and its loss of velocity on impact. The panel found that fruitful examination of this bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 850.)

(124) *CE 857*.—One fired 6.5-millimeter caliber full metal jacketed bullet, test-fired into a skull at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration. The panel found that the jacket had been separated from the core. The panel also found that fruitful examination of the bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 851.)

(125) *Lester Bullet*.—One fired metal-jacketed soft or hollow point bullet found in 1974 by Richard Lester about 500 yards from the Texas School Book Depository and 61 paces east of the triple overpass abutment. (See fig. 19.)

Findings and Conclusions

Was the CE 141 cartridge reportedly found in the CE 139 rifle in fact loaded into that rifle?

(126) The CE 141 cartridge was compared with the panel's unfired test cartridge No. 4, which had been loaded into the rifle and removed. The panel found a correspondence between the individual identifying characteristics produced by the magazine follower and the loading ramp of the CE 139 rifle on the CE 141 cartridge case and the panel's unfired cartridge. (See fig. 20.)

(127) In the Mannlicher-Carcano rifle, the loading ramp consists of a concave ramp located at the front edge of the magazine. It permits smooth insertion of the cartridge into the chamber. When a cartridge is chambered by moving the bolt forward, the front portion of the cartridge case slides up the loading ramp as it leaves the magazine. The loading ramp is a machined-steel surface and can engrave individual microscopic identifying characteristics on the cartridge case. Similarly, the magazine follower, which raises the cartridges, also may engrave individual microscopic identifying characteristics on the last cartridge in the magazine.

From which direction was the impact which damaged the CE 351 windshield of the Presidential limousine?

(128) The CE 351 windshield, made of two layers of laminated, tinted glass, has two separate fracture areas. (See fig. 5.) In the first (I), the point of impact is located $13\frac{3}{8}$ inches down from the top edge and $22\frac{7}{8}$ inches to the right of the left edge (the measurements were made from the front side of the windshield). No fractures were noted on the inside surface of the glass. On the outside surface, some fracture lines radiated out from the point of impact. The presence of fracture lines on the outside is indicative of a foreign object striking the windshield from the inside. (74)

(129) The second area (II) is located to the left of the first. No point of impact was found.

(130) Two lines, one radiating from each area, now connect at one point. This condition occurred after the panel's examination, but before the windshield was photographed. The additional fracture lines could have been caused by jolting the windshield during its removal from its exhibit case for photographing.

Were the three expended cartridge cases (CE 543, CE 544 and CE 545) found on the sixth floor of the Texas School Book Depository fired in the CE 139 Mannlicher-Carcano rifle?

(131) The panel compared microscopically the three expended cartridge cases (CE 543, CE 544, and CE 545) with the two cartridge cases test-fired by the FBI (CE 557) and the four cartridge cases (Kennedy T-1 to T-4) test-fired by the panel in the CE 139 rifle.

(132) The panel found correspondence among the individual identifying characteristics made by the firing pin and bolt face on the cartridge cases. (See Figs. 21A, B, C, and D.)

(133) The panel found, in addition to the above impressions, three sets of striations on the head of the CE 543 cartridge case. The marks were not found on any of the other 6.5-millimeter caliber cartridge cases. The origin of the marks could not be established.

(134) The panel concluded that all three cartridge cases had been fired in the CE 139 rifle.

Was the CE 399 bullet found at Parkland Hospital fired from the CE 139 Mannlicher-Carcano rifle?

(135) The CE 399 bullet is a 6.5-millimeter caliber full metal-jacketed, lead core bullet with a weight of 157.7 grains. The class characteristics engraved on it are four lands and four grooves, right twist.

(136) The panel found the physical characteristics of CE 399 to be the same as those of the bullet portion of the CE 141 cartridge found in the Mannlicher-Carcano rifle's chamber.

(137) CE 399 was microscopically compared with the two bullet test-fired by the FBI (CE 572) in the CE 139 rifle. Based in a correspondence of individual identifying characteristics, the panel concluded that CE 399 was fired through the same firearm barrel as the FBI test-fired bullets. (See fig. 22A and 22B.)

(138) Next, the panel compared CE 399 with bullets it test-fired in the CE 139 rifle. The panel was unable to identify its test-fired bullets

with the CE 399 bullet. The panel attributed this to changes in the bore caused by repeated firings of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy, (75) as well as to deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

Was the CE 567 bullet nose portion found on the right side of the front seat of the Presidential limousine fired from the CE 139 Mannlicher-Carcano rifle?

(139) CE 567 is the nose portion of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of the exhibit is 41.5 grains. The class characteristics on the jacket are four lands and four grooves. The panel could not determine the direction of twist.

(140) The panel found the physical characteristics of this bullet fragment to be the same as the bullet portion of the CE 141 cartridge found in the chamber of the CE 139 rifle. When it compared CE 567 with the two CE 572 bullets test-fired by the FBI in the CE 139 rifle, it noted a correspondence among the individual identifying characteristics. (See fig. 23A and 23B.)

(141) The panel concluded that all were fired through the same barrel.

(142) The panel also compared CE 567 with bullets it test-fired in the CE 139 rifle. The panel was unable to identify its tests with CE 567. The panel attributed this to changes in the bore caused by repeated firing of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy, (76) as well as deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

Was the CE 569 bullet-base portion found on the floor beside the right front seat of the Presidential limousine fired from the CE 139 rifle?

(143) CE 569 is a base portion of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of 20.6 grains. The rifling impressions on the jacket are four lands and four grooves, right twist. The physical characteristics of this bullet are the same as the bullet portion of the CE 141 cartridge found in the chamber of the CE 139 rifle.

(144) The panel microscopically compared this bullet jacket with the two bullets (CE 572) test fired by the FBI from the CE 139 rifle. Correspondence of individual identifying characteristics was found on CE 569 and the FBI test-fired bullets. (See figs. 24A and 24B.)

(145) The panel concluded that the CE 569 was fired through the same barrel as the FBI test-fired bullets.

(146) Next, the panel compared CE 569 with bullets it test fired in the CE 139 rifle. The panel was unable to identify its tests with the

CE 569. The panel attributed this to changes in the bore caused by repeated firings of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy,(77) as well as to deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

Were the CE 567 bullet nose portion and the CE 569 bullet base portion found in the Presidential limousine components of the same bullet?

(147) The panel was unable to determine whether CE 567 and CE 569 were components of the same bullet. The panel weighed and measured the fragments and found their combined weight and length did not exceed that of a single-fired projectile. Nevertheless, the panel could not match the two fragments physically because a considerable portion of the bullet jacket was absent.

(148) Both bullet fragments were examined for cannellures. The panel found only one cannellure present; it was on the base portion of the CE 569 bullet.

Was the CE 573 bullet recovered from the residence of General Walker fired from the CE 139 rifle?

(149) CE 573 consists of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of this exhibit is 147.1 grains. The class characteristics are four lands and four grooves, right twist. (See fig. 14.)

(150) The panel compared this bullet microscopically with the FBI's and its own test-fired bullets. Correspondence among the class characteristics was found on all bullets. No significant correspondence was, however, found among the individual identifying characteristics. Conversely, gross differences were not found.

(151) The panel concluded that because of the damage to CE 573 caused by impact and penetration, it could not be identified or eliminated as having been fired from the CE 139 rifle.

What are the nature and characteristics of the 6.5-millimeter caliber Mannlicher-Carcano rifle and ammunition with respect to power and impact?

(152) The 6.5-millimeter caliber Mannlicher-Carcano rifle is a bolt-action military rifle used as the standard service rifle by the Italian military from 1891 to 1945. It was chambered for a 6.5-millimeter caliber Mannlicher-Carcano cartridge. It was comparable to the service rifles of other nations at that time. These rifles include the U.S. model 1903 Springfield and 1917 Enfield, chambered for the .30-06 Springfield caliber cartridge; the British .303 Enfield, chambered for the .303 British caliber cartridge; the German 8-millimeter Mauser, chambered for the 8-millimeter Mauser caliber cartridge; and the Japanese Arisaka, chambered for both the 7.7-millimeter Arisaka caliber cartridge and 6.5-millimeter caliber Japanese Arisaka cartridge. The standard military factory statistics for these cartridges are:(78)

Cartridge	Bullet weight (grains)	Muzzle velocity (feet per second)	Muzzle energy (foot per pound)
.30-06 Springfield.....	150	2,990	2,980
.303 British.....	174	2,440	2,310
8-millimeter Mauser.....	154	2,880	2,835
7.7-millimeter Japanese Arisaka.....	175	2,400	2,237
6.5-millimeter Mannlicher-Carcano.....	162	2,296	1,902
6.5-millimeter Japanese Arisaka.....	156	2,060	1,460

Could the CE 139 rifle have been fired with a high degree of accuracy even though it has been described as having a "hair trigger"?

(153) The trigger pull of CE 139 is approximately 3 pounds, not considered average for most military rifles. At the same time, it cannot be called "a hair trigger." Technically, a hair trigger requires an extremely light pull, normally measured at 16 ounces or less. Furthermore, the panel's examination of CE 139 disclosed that, as in most military weapons, it has a two-stage trigger that requires some movement of the trigger before the sear mechanism is engaged, allowing the weapon to fire.

(154) It is the opinion of the panel that the CE 139 does not have a hair trigger that would affect accurate aiming and firing.

Would the dent on the mouth of CE 543, one of the three expended cartridge cases found on the sixth floor of the Texas School Book Depository, prevent the bullet from being fired in the CE 139 Mannlicher-Carcano rifle, or any other rifle? Can it be determined whether these cartridge cases had been chambered on more than one occasion?

(155) Figure 8B shows a dent on the mouth of the CE 543 cartridge case which Josiah Johnson, a critic of the Warren Commission, said would prevent CE 543 from being fired in any rifle. (79)

(156) It is the opinion of the panel that the dent on the mouth of the CE 543 cartridge case was produced when the cartridge case was ejected from the rifle. This condition was duplicated during test-firing of the CE 139 rifle by the panel. (See fig. 2.) The dent had nothing to do with loading the bullet during the manufacturing process, nor is it the type of deformation expected if the case were stepped on.

(157) There was no evidence in the form of multiple extractor or ejector marks on the cartridge case to indicate that it was chambered in the rifle more than once. This also applies to cartridge cases CE 544 and CE 545.

Does the method of mounting a scope on a rifle affect, or have any influence on whether the rifle can be fired by a left-handed individual?

(158) There is no such thing as a left- or right-handed telescopic sight. The location of a telescopic sight on a rifle is determined not by whether it is to be shot left-handed or right-handed, but rather by such factors as receiver design, cartridge case ejection direction and bolt handle travel pattern. On CE 139, the telescopic sight is mounted on the left side of the receiver because of the vertical bolt handle travel pattern and the split receiver (see fig. 1). Because this rifle has a right-

handed action, a telescopic sight cannot be mounted on the right side of the receiver.

(159) The position of the bolt in a bolt-action rifle, that is, right- or left-handed action, is the factor that influences ease of operation, rather than the placement of the telescopic sight. A left-handed action would be difficult for a right-handed individual to operate, and conversely, a right-handed action would be difficult for a left-handed individual to operate.

The Warren Commission found that the CE 399 stretcher bullet weighed 158.6 grains (80) when recovered and assumed its original weight before firing to have been 160-161 grains. Is it possible that the CE 399 bullet sustained a weight loss of only 1.4 to 2.4 grains during the wounding of President Kennedy and Governor Connally?

(160) Because of manufacturing variations, all bullet weights are approximate, and it is not possible to determine the exact weight loss of a fired bullet without knowing its exact weight prior to firing. Nevertheless, it is possible that the weight loss from friction, pressure and intense heat during the firing process, and the weight loss caused by impact and penetration, would not have exceeded the range of 1.4 to 2.4 grains. The panel was, however, unable to render a definite opinion.

Could a 6.5-millimeter caliber Mannlicher-Carcano rifle be easily mistaken for a 7.65-millimeter caliber German Mauser rifle? What are the obvious differing characteristics, if any?

(161) In the opinion of the panel, a Mannlicher-Carcano rifle could very easily be mistaken for other military rifles of its general type, including the 7.65-millimeter caliber German and other model Mausers.

(162) At one time, bolt-action rifles like the German Mauser, the Argentine Mauser (which is made in Germany) and the Mannlicher-Carcanos were the standard military weapons of most countries. Although manufactured in many different calibers and models, all have the same general characteristics—right-hand action (bolt mechanisms), a full-length wooden stock covering most of the barrel, a sling attachment, bayonet mounting lugs and a generally rough and dull appearance. In the absence of a complete examination, almost any such bolt-action military rifle could be confused with a Mannlicher-Carcano rifle. (See figs. 1, 2, and 25.)

(163) Further, the caliber of a rifle cannot be determined merely by looking at it. For example, the bore of the 7.65-millimeter caliber German Mauser, or other 7.65-millimeter caliber rifles, is only 0.05 inches larger than the 6.5-millimeter caliber Mannlicher-Carcano. Even if a knowledgeable individual identified a particular rifle after a cursory examination, it is unlikely that the caliber could be readily established without further examination.

Was the bullet found in 1974 by Richard Lester near the Texas School Book Depository fired from the CE 139 Mannlicher-Carcano rifle?

(164) The panel found the Lester bullet to be the base portion of a metal-jacketed, softpoint or hollowpoint bullet. It weighs 52.7 grains and is consistent in diameter with 6.5-millimeter caliber bullets. The rifling impressions are four lands and four grooves, right twist.

(165) The panel found that the physical characteristics of this bullet were different from the CE 399 bullet recovered at Parkland Hospital and the CE 567 and CE 569 bullet fragments recovered from the Presidential limousine. When the panel compared the bullet microscopically with the CE 572 FBI test-fired bullets, it noted gross differences among class characteristics. As a result, the panel concluded that this bullet was not fired through the same firearm barrel as the FBI test-fired bullets.

Could the iron sights found on the CE 139 Mannlicher-Carcano rifle be used with a high degree of accuracy and operability, as compared with the telescopic sight?

(166) The iron sights found on CE 139 are the standard, fixed sights placed on the firearm at the time of manufacture at the military arsenal. On CE 139, a block of metal is attached to the area immediately in front of the chamber area. A V-shaped notch in this piece of metal acts as the rear sighting alinement device. The sighting is made by lining up the front sight in the notch of the rear sight. A fixed sight cannot be adjusted for windage or elevation.

(167) The 4X scope mounted on this particular weapon is designed so that the cross hairs move from the center position when adjusting for windage or elevation. Hence the shooter is not always looking dead center through the scope.

(168) It is the opinion of this panel that an individual could attain better accuracy using the iron sights than the scope under the circumstances involved in Dealey Plaza.

Do rifles using smokeless powder emit smoke discernible to the eye when fired?

(169) When a cartridge is fired, the propellant is not completely consumed or burned. Due to this, residue and smoke are emitted. During the test firing of CE 139 by the members of the panel, in October, some smoke was observed coming from the muzzle of the weapon.

TIPPIT MURDER

Evidence examined

(170) CE 143—One .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, seized from Oswald when he was apprehended in the Texas theater. (See figs. 26A and 26B.)* The barrel is rifled with five lands and five grooves, right twist. The cylinder has a six-cartridge capacity.

(172) The CE 143 revolver had been altered to accept .38 special caliber ammunition and presumably to allow easier concealment, as follows:

1. The barrel had been shortened from the muzzle end to its present length of $2\frac{1}{4}$ inches.
2. The muzzle end had been recrowned.
3. The cylinder had been rechambered from .38 S. & W. caliber to accommodate .38 special caliber cartridges.
4. The front sight had been reset.

*The panel found the revolver to be in good operating condition. It can be fired single action or double action. The trigger pull was measured at about $3\frac{1}{2}$ pounds single action and $10\frac{1}{4}$ pounds double action.

5. The "U.S. Property" markings located on the left side of the top strap had been partially obliterated.

6. The lanyard swivel and ring had been removed and the hole filled with metal.

(173) CE 143 was test-fired four times by the panel into a horizontal water recovery tank, using two Western Cartridge Co. .38 special caliber cartridges with 158-grain, copper-coated (Lubaloy), lead, round-nose bullets, and two Remington-Peters .38 special caliber cartridges with 158-grain, plain lead, round-nose bullets.

(174) CE 518—Four cartridges found in the CE 143 revolver. Two cartridges, designated Q78 and Q79 by the FBI, are Western Cartridge Co. .38 special caliber cartridges with copper-coated (Lubaloy), lead, round-nose bullets. The other two, designated Q80 and Q81 by the FBI, are Remington-Peters .38 special caliber cartridges with plain lead, round-nose bullets.* (See fig. 27.)

(175) CE 587—One Western Cartridge Co. .38 S. & W. caliber cartridge with a copper-coated (Lubaloy), lead, roundnose bullet, acquired by the FBI and used as a standard. (See hearings before the Warren Commission, vol. 17, p. 264.)

(176) CE 588—One Western Cartridge Co. unfired .38 S. & W. caliber cartridge case and one unfired .38 caliber copper-coated (Lubaloy), lead, round-nose bullet, weighing 145.1 grains and measuring 0.635 inch long, acquired by the FBI. Both were used as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(178) CE 589—Assembled and disassembled cartridges—one Remington-Peters .38 S. & W. caliber cartridge with a plain lead, round-nose bullet measuring 1.20 inches long overall; one Remington-Peters unfired .38 S. & W. caliber cartridge case measuring 0.763 inch long and one unfired .38 S. & W. caliber plain lead, round-nose bullet measuring 0.661 inch long. The FBI used these as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(179) CE 590—Assembled and disassembled cartridges—one Western Cartridge Co. .38 special caliber cartridge with a copper-coated (Lubaloy), lead, round-nose bullet measuring 1.530 inches long; one unfired Western Cartridge Co. .38 special caliber cartridge case measuring 1.150 inches long; and one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet measuring 0.730 inch long. The cartridges and components in this exhibit were used by the FBI as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(180) CE 591—Assembled and disassembled cartridges—one Remington-Peters .38 special caliber cartridge with a plain lead, round-nose bullet measuring 1.550 inches long overall; one unfired Remington-Peters .38 special caliber cartridge case measuring 1.150 inches long; and one .38 caliber plain lead, round-nose bullet measuring 0.730 inch long. The FBI used these as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(181) CE 592—Five Western Cartridge Co. .38 special caliber cartridges with copper-coated (Lubaloy), lead, round-nose bullets, found

*The panel's visual and microscopic examinations revealed no markings that could be attributed to any attempt to discharge them in a firearm.

in Oswald's trouser pocket, designated Q82 through Q86 by the FBI.* (See fig. 28.)

(183) *CE 594.*—Four expended cartridge cases retrieved from the scene of the Tippit murder, designated Q74 through Q77 by the FBI. Q75 and Q76 are .38 special caliber of Western Cartridge Co. manufacture; Q74 and Q77 are .38 special caliber of Remington-Peters manufacture. (See fig. 29.)

(184) *CE 595.*—Two cartridge cases test-fired by the FBI in the CE 143 revolver—one Winchester Repeating Arms .38 special caliber designated K3 by the FBI** and one Western Cartridge Co. .38 special caliber, designated K8 by the FBI. (See fig. 30.)

(185) *CE 602.*—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, and one damaged, brass-colored button with the lettering "city of Dallas." The bullet and button were removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 155.4 grains. (See fig. 31.)

(186) *CE 603.*—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 155.1 grains. (See fig. 32.)

(187) *CE 604.*—One .38 special caliber lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Remington-Peters manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 154.7 grains. (See fig. 33.)

(188) *CE 605.*—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 152.8 grains. (See fig. 34.)

(189) *CE 606.*—Two bullets test-fired by the FBI in the CE 143 revolver, as follows: One .38 special caliber lead, round-nose bullet consistent with Winchester Repeating Arms manufacture; and one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet consistent with Western Cartridge Co. manufacture. (See hearings before the Warren Commission, vol. 17, p. 271.)

(191) *Panel Tippit T-1—T-4.*—T-1 and T-2: .38 special caliber cartridges of Remington Cartridge Co. manufacture, with lead bullets (see figs. 35A, 35B, and 35E); T-3 and T-4: .38 special caliber cartridges of Western Cartridge Co. manufacture with copper-coated (Lubaloy), lead, round-nose bullets (see figs. 35C, 35D, and 35E).

(192) All cartridges were test fired by the panel into a horizontal water-recovery tank.

Findings and Conclusions

What are the dimensional differences of a .38 S. & W. caliber cartridge and a .38 special caliber cartridge? Can a .38 special caliber

*The panel's visual and microscopic examination revealed no markings which could be attributed to any attempt to discharge them in a firearm.

**The panel found a split in the side of the Winchester Repeating Arms cartridge case. (See fig. 30.)

cartridge be inserted in a weapon chambered for a .38 S. & W. caliber cartridge? Would this cause the side of the cartridge case to split, as happened with the CE 595 cartridge case test fired by the FBI in Oswald's revolver?

(193) A .38 S. & W. caliber cartridge and the .38 special caliber cartridge differ in the diameter of the neck, head and rim, and in length. The standard dimensions are: (81)

[In inches]

	.38 S & W	Average	.38 special	Average
Diameter neck-----	0. 375-0. 386	0. 380	0. 372-0. 378	0. 375
Diameter head-----	. 379-. 386	. 381	. 372-. 379	. 376
Diameter rim-----	. 424-. 441	. 433	. 424-. 444	. 434
Length-----	. 725-. 794	. 760	1. 120-1. 168	1. 144

(194) The .38 S&W caliber cartridge is approximately 0.005 inch larger in neck and head diameters, 0.001 inch smaller in rim diameter, and 0.384 inch shorter in case length. (82)

(195) Overall length of the .38 S&W caliber cartridge is approximately 1.20 inches. Overall length of the .38 special caliber cartridge is approximately 1.55 inches. (83)

(196) A revolver designed and manufactured to accept a .38 S&W caliber cartridge cannot fire a .38 special caliber cartridge without modification. One common method of modification is rechambering the cylinder.

(197) The panel noted that one of the FBI test-fired cartridge cases was split on the side. The panel attributed this split to one or more of the following factors: (1) The oversized chamber on the CE 143 revolver; (2) a weak cartridge case sidewall; or (3) excessive chamber pressures. During the panel's test firing of the CE 143 revolver, one test cartridge case split in a similar manner, which it attributed to the same possible causes.

Were the four cartridge cases (CE 594) recovered from the scene of the Tippit murder fired in the CE 143 revolver recovered from Oswald when apprehended?

(198) The panel microscopically compared the four CE 594 cartridge cases with the two CE 606 cartridge cases test-fired by the FBI and the four cartridge cases test fired by the panel in the CE 143 revolver. The panel found correspondence among the individual identifying characteristics produced by the firing pin and breech face. The panel concluded the four CE 494 cartridge cases were fired in the CE 143 revolver. (See figs. 36 A, B, C, and D and 36E.)

Were the four bullets recovered from officer Tippit's body (CE 602 through CE 605) fired from the CE 143 revolver recovered from Oswald when apprehended?

(199) The panel conducted microscopical examinations and comparisons of the four bullets recovered from Tippit's body (CE 602 through CE 605), the two bullets test fired by the FBI (CE 606), and the four

bullets (Tippit T-1 through T-4) test fired by the panel in the CE 143 revolver.

(200) The panel found correspondence among the class characteristics on all the fired bullets. Nevertheless, no significant correspondence was found among the individual identifying characteristics of CE 602 through CE 605 and the test-fired bullets. Conversely, no gross differences were found. The finding was inconclusive because of the extensive damage to the bullets recovered from Tippit's body. The panel attributed this to the effects of impact, penetration and wiping. Portions of the bearing surfaces of the CE 602 through CE 605 bullets also showed indications of gas erosion, which is caused by the hot gases produced by the burning of the propellant powder. The panel attributed this to the firing of either undersized bullets through the CE 143 barrel or the barrel of the revolver having become oversized due to wear and deterioration.

(201) The panel's two test-fired lead bullets could be identified with each other, as could its two test-fired copper-coated (Lubaloy) lead bullets. The lead and the copper-coated bullets could not, however, be identified with one another. The panel attributed these differences to variations in the composition of bullet surface materials.

(202) Due to the inconsistent markings on the recovered bullets and on all the test-fired bullets, the panel concluded that the CE 602 through CE 605 bullets could not be conclusively identified or eliminated as having been fired from the CE 143 revolver. (See figs. 31, 32, 33, 34, 35A, 35B, 35C, and 35D.)

Of the four expended cartridge cases found at the scene of the Tippit murder, two were of Western Cartridge Co. manufacture, two of Remington-Peters. The autopsy of Tippit, however, revealed three bullets of Western Cartridge Co. manufacture and one of Remington-Peters. Can the panel formulate an opinion about this discrepancy? Is it possible to determine which bullet came from each particular cartridge case?

(203) The two expended .38 special caliber cartridge cases (CE 574—Q75 and Q76) of Western Cartridge Co. manufacture and three of the recovered .38 special caliber copper-coated (Lubaloy) lead bullets (CE 602, CE 603, and CE 605) are components of Western Cartridge Co. ammunition. The two expended Remington-Peters cartridge cases (CE 594—Q74 and Q77) and the recovered .38 special caliber lead bullet (CE 604) are components of Remington-Peters Co. ammunition.

(204) The panel concluded that they were all components of factory-loaded ammunition. Visual and microscopical examination of the recovered cartridge cases revealed no evidence of reloading. It is logically assumed that cases and bullets of the same manufacture could have originated from the recovered cartridge cases and bullets, but the panel can render no opinion beyond this. There is no known scientific procedure that can conclusively relate a fired bullet to an expended cartridge case.

(205) The panel offers two possible explanations for the discrepancy:

1. One Western cartridge case was not recovered or is missing, and one Remington-Peters lead bullet missed Officer Tippit and also was not recovered.
2. One Western cartridge case was not recovered or is missing, and one fired Remington-Peters cartridge case was in the revolver prior to the Tippit shooting.

(206) Inasmuch as the panel's examinations were related to physical evidence only, a hypothesis to account for the discrepancy regarding the recovered cartridge cases and bullets is speculation. (See figs. 24, 31, 32, 33, and 34.)

OSWALD MURDER

Evidence examined

(207) *Jack Ruby Revolver.*—A .38 special caliber Colt Cobra revolver, serial No. 2744-LW, recovered from Jack Ruby at the time of his arrest in the Dallas Police Department basement on November 24, 1963. (See figs. 37A and 37B.)*

(209) *Panel Ruby T-1 through T-6:*

—*Ruby T-1 and T-2*—Two .38 special caliber cartridges of Remington-Peters manufacture, with 158-grain, plain lead, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38A.)

—*Ruby T-3 and T-4*—Two .38 special caliber cartridges of Western Cartridge Co. manufacture, with 158-grain, copper-coated (Luballoy), lead, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38B.)

—*Ruby T-5 and T-6*—Two .38 special caliber cartridges of Remington Arms Co. manufacture, with 130-grain, full metal-jacketed, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38C.)

Findings and conclusions

Are there any characteristics which are easily identifiable on Jack Ruby's revolver? Does it have a "hair trigger"?

(210) There was nothing out of the ordinary about Jack Ruby's revolver except that it had a hammer shroud, which is an attachment that covers most of the hammer of a weapon. The purpose of a shroud is to prevent the hammer from snagging on clothing. It was impossible to determine if the shroud was installed at the factory.

(211) The trigger pull was found to be slightly above the maximum weight specified by the factory; the revolver, therefore, cannot be said to have a "hair trigger."

What can the panel determine from an examination of the Ruby evidence?

(212) The panel members conducted a microscopical examination and comparison of the cartridge case and bullet components of two of its test-fired cartridges (Panel Ruby T-5 and T-6). Based on the correspondence among the individual identifying characteristics produced by the breech face and firing pin, the panel concluded that the cartridge cases could be identified with each other. Regarding the bullet components, they could also be identified with each other, based on the correspondence of individual identifying characteristics.

*The panel physically examined the revolver and found it to be in good operating condition. It can be fired single action or double action. The trigger pull was measured at approximately 5 pounds single action and 10½ pounds double action, slightly above the maximum weight specified by the factory. The barrel is rifled with six lands and six grooves, left twist. The cylinder has a six-cartridge capacity.

(213) Photomicrograph and microscopical comparisons of the panel's test-fired cartridge cases and bullets with those connected with Oswald's murder were not conducted. As noted earlier, the bullets that killed Oswald and the expended cartridge case recovered from the Ruby revolver were not located by the committee. This evidence was presented at Jack Ruby's trial, but its ultimate disposition was unknown. The panel recommended that an appropriate examination be conducted on this evidence if and when it is located.

SUMMARY AND CONCLUSIONS

(214) The CE 139 Mannlicher-Carcano military rifle was found by the panel to be operable. It was in generally poor condition because of a lack of proper cleaning, maintenance or lubrication. Although the trigger pull was found to be light, the panel concluded it was not a "hair trigger." The mounting of the telescopic sight on the left side of the rifle was done as a matter of necessity because the bolt action is on the right side.

(215) As to the misidentification of the rifle as a German Mauser, many bolt-action military rifles are so similar in profile that misidentification may occur.

(216) After examining the CE 141 cartridge found in the chamber of the CE 139 rifle, the panel concluded that it had in fact been worked through the action of that rifle from the magazine.

(217) The three expended cartridge cases found on the sixth floor of the depository building were compared microscopically by the panel with the FBI test-fired cartridge cases and those test-fired by the panel in the CE 139 rifle. Based on a correspondence of individual identifying characteristics produced by the firing pin and bolt face, the panel concluded that all three were fired in the CE 139 rifle.

(218) In the opinion of the panel, the dent on the mouth of the CE 543 case (one of three found on the sixth floor) was made by the CE 139 rifle during ejection. The panel duplicated the dent when it test-fired the rifle.

(219) The panel found no evidence of multiple extractor or ejector marks on the cartridge cases which would indicate that they had been chambered on more than one occasion.

(220) The panel compared microscopically the CE 399 stretcher bullet with the two bullets test-fired by the FBI (CE 572) in the CE 139 rifle. Based on a correspondence of individual identifying characteristics, the panel concluded that CE 399 was fired from the same barrel as the FBI test-fired bullets.

(221) The panel then compared microscopically the bullets it test-fired in the CE 139 rifle with the FBI test-fired bullets and with the CE 399 stretcher bullet. The panel was unable to identify its test-fired bullets with those of the FBI or with the CE 399 bullet, nor could the panel's test-fired bullets be identified with each other. The panel attributed the results to one or more of the following factors:

1. Repeated test-firing of the CE 139 rifle, which had caused extensive changes in the rifling characteristics within the barrel, or
2. Deterioration of rifling surfaces within the barrel of the CE 139 rifle over an extended period of time because of a lack of proper cleaning, maintenance, and protective lubrication.

(222) The panel compared the CE 567 bullet fragment (nose portion) and the CE 569 bullet fragment (base portion), both found in the limousine, with the two FBI test-fired bullets (CE 572). Based on a correspondence of their individual identifying characteristics, the panel concluded that CE 567, CE 569, and the two FBI test-fired bullets were all fired through the same barrel. Again, the panel was unable to identify these bullets and fragments with its own test-fired bullets. The panel was unable to determine if CE 567 and CE 569 originated from the same bullet.

(223) The CE 573 Walker bullet was compared microscopically with the FBI test-fired bullets. A correspondence of class characteristics was found, but a correspondence of individual identifying characteristics was not found. Conversely, no gross differences were noted. The panel concluded that the Walker bullet was too damaged to allow conclusive identification of the bullet with a particular firearm.

(224) Because of their minute size, microscopic examinations were not performed on the following: CE 840—lead-like fragments found in the limousine; CE 841—lead residue removed from the limousine's windshield; CE 842—four lead-like fragments removed from Governor Connally's wrist; and CE 843—three lead-like fragments removed from President Kennedy's brain during his autopsy at Bethesda Naval Hospital.

(225) The panel concluded from its examination of the bullet fragment found near the depository building by Richard Lester in 1974 that it was not fired through the same barrel as the FBI test-fired bullets and that its physical characteristics were different from the CE 399 stretcher bullet and the CE 567 and CE 569 bullet fragments found in the Presidential limousine.

(226) The panel found the CE 143 Oswald revolver to be in good operating condition. The trigger pull was not considered exceptionally light and could not be considered a "hair trigger." The revolver had been altered; changes included the shortening of the barrel and the modification of the chamber to accommodate .38 special caliber cartridges.

(227) The panel compared microscopically the four expended cartridge cases found at the scene of the Tippit murder (CE 594) with the cartridge cases test-fired by the FBI and by the panel in the CE 143 revolver. Based on the correspondence of individual identifying characteristics produced by the breech face and firing pin, the panel concluded that all four cartridge cases were fired in the CE 143 revolver. The panel also examined the five cartridges found in Oswald's pocket after his arrests (CE 592). No marks were found that could be attributed to an attempt to discharge them in a firearm.

(228) The panel noted that one of the FBI test-fired cartridge cases was split on the side. The panel attributed this split to either an oversized chamber, a weak cartridge case sidewall, excessive chamber pressure, or some combination of these factors. One of the panel's test-fired cartridge cases split in a similar manner during the test-firing of the CE 143 revolver.

(229) The panel examined the four bullets removed from the body of Officer Tippit during his autopsy. All four had sustained considerable damage from impact, penetration, and wiping. CE 604 was found

to be consistent with Remington-Peters manufacture, while CE 602, 603, and 605 were found to be consistent with Western Cartridge Co. manufacture. A correspondence was found among the number of lands and grooves and direction of twist of all four bullets, but no significant correspondence among individual identifying characteristics was found when the Tippit bullets were compared with bullets test-fired by the FBI or the panel in the CE 143 revolver. Consequently, the panel was unable to conclude that the Tippit bullets were fired from the CE 143 revolver. Conversely, the panel was unable to eliminate the bullets as having been fired from the CE 143 revolver.

(230) The Tippit bullets, the FBI, and the panel test-fired bullets all showed variations in their individual identifying characteristics, which commonly result from firing under-sized bullets in a barrel or the firing of normal-sized bullets in a firearm that has become oversized due to wear and deterioration.

(231) The panel took note of a discrepancy between the brand of the bullets removed from Tippit's body and the brand of the cartridge cases found at the Tippit murder scene. Three of the recovered bullets were of Western Cartridge Co. manufacture, the fourth of Remington-Peters manufacture. Of the four recovered cartridge cases, however, two were of Western Cartridge Co. manufacture and two were of Remington-Peters manufacture. The panel gave two possible explanations. First, one Western cartridge case was not recovered and one Remington-Peters bullet missed Officer Tippit and also was not recovered. Second, one Western cartridge case was not recovered, and one Remington-Peters cartridge case was in the revolver prior to the Tippit shooting. The panel noted that its function was to examine the physical evidence as presented by the select committee. Hypotheses about the discrepancies in the physical evidence were beyond its scope of responsibility.

(232) The Jack Ruby revolver, which was seized from him at the time of his apprehension in the basement of the Dallas Police Department, was examined by the panel and found to be in good operating condition. The trigger pull was measured and found to be in the normal range; the revolver did not have a "hair trigger."

(233) The barrel of the Ruby revolver is rifled with six lands and six grooves, left twist. The only thing out of the ordinary is that the revolver has a hammer shroud, which protects against snagging on clothing. There was no way to determine if the shroud was put on the revolver at the factory.

(234) The panel could not conduct a microscopical examination of the fatal bullet or the cartridge case from which it originated because the evidence has not been located. The panel suggested that such an examination be conducted when and if the evidence is found.

Recommendations of the firearms panel

(235) The panel found that the firearms evidence had not been maintained in proper condition. It strongly recommended that the firearms evidence—cartridges, cartridge cases, bullets and fragments—be permanently sealed. More specifically:

1. All foreign material should be removed from the exhibit with a mild solution of saline or hemosol.

2. After cleaning, they should be handled with cotton gloves to prevent oxidation from body fluids.
 3. They should then be sealed in airtight plastic containers.
- (236) With respect to the rifle and revolver, the panel recommended that:
1. The foam rubber packing material in their storage cases should be removed and replaced with nonmoisture absorbing partitions.
 2. The storage cases should have small ventilation holes drilled in them to prevent condensation.
 3. The rifle and revolver should be cleaned and lightly oiled or protected with a silicone compound. All future handling should be done with clean cotton gloves.
- (237) The cleaning and sealing of the evidence could appropriately be done by the firearms panel.

ILLUSTRATIONS

4



3



Panel Test

#3 & #4 Bullets

5-25-'78

DATE

FVII

FIGURE 1.—Panel test-fired bullets from the CE 139 rifle.

A.



FIGURE 2.—Cartridge cases test-fired in the CE 139 rifle by the panel. Note the dent on the mouth of case No. 2, similar to the dent on the CE 543 cartridge case (see fig. 8B).

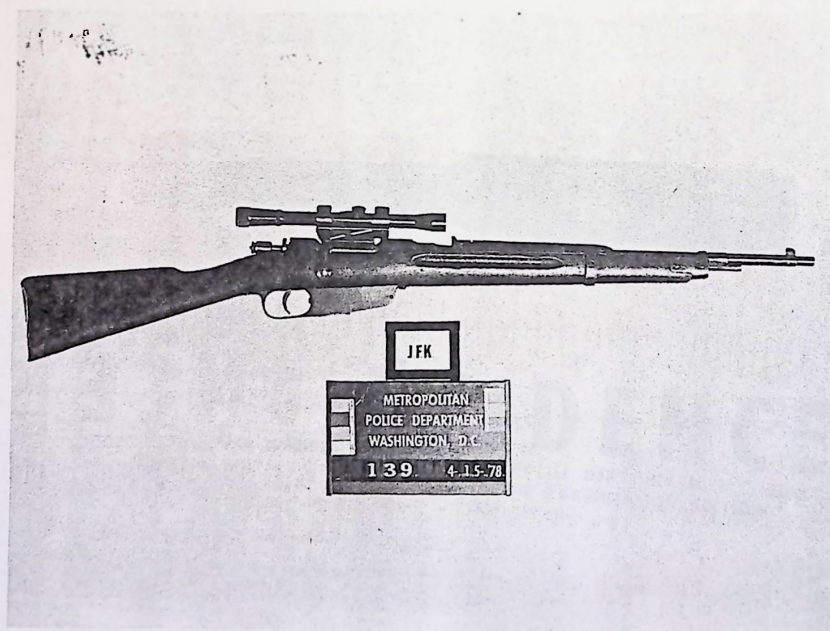


FIGURE 3A.—The CE 139 0.5-millimeter caliber Mannlicher-Carcano rifle, serial No. D2766, right side.

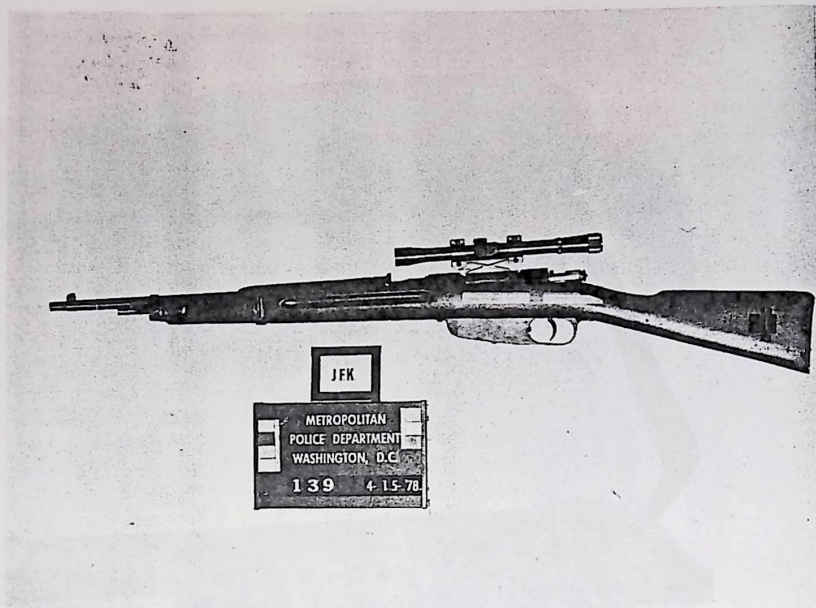


FIGURE 3B.—The CE 139 6.5-millimeter caliber Mannlicher-Carcano rifle, serial No. D2766, left side.

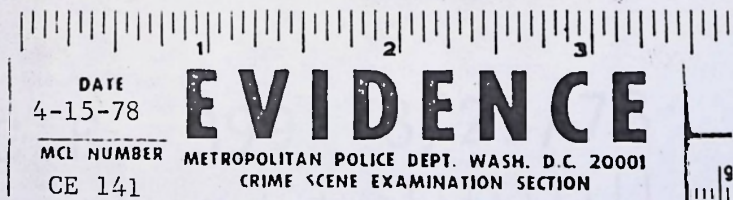


FIGURE 4.—CE 141, a 6.5-millimeter caliber cartridge of Western Cartridge Co. manufacture, found in the chamber of CE 139 rifle.

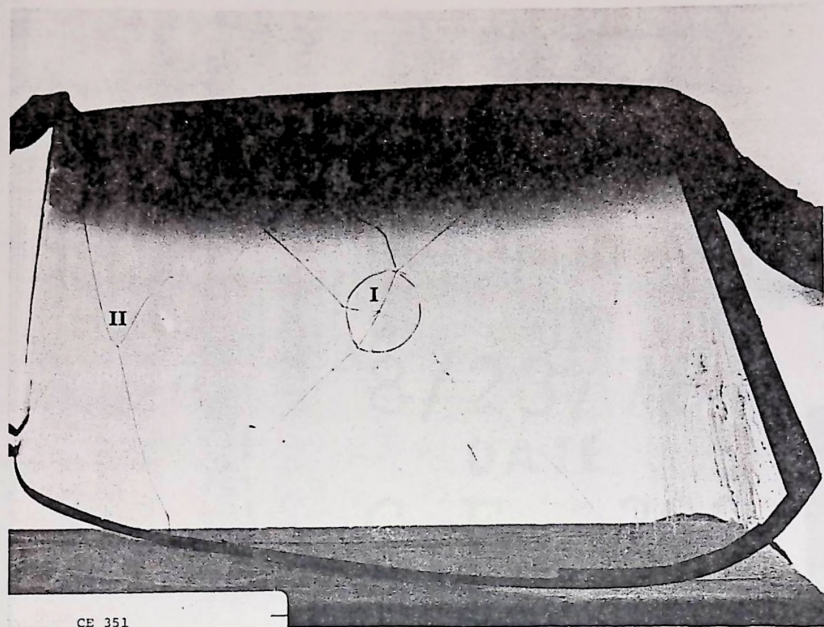


FIGURE 5.—Damaged CE 135 windshield removed from the Presidential limousine, front view.



C.E. 399 8/23/78

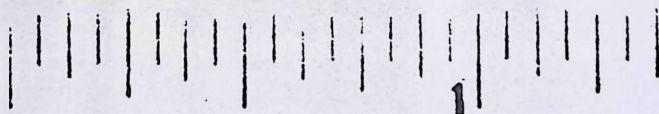


FIGURE 6A.—CE 399, the fired 6.5-millimeter caliber full metal-jacketed bullet found on a stretcher in the emergency area of Parkland Memorial Hospital, side view.

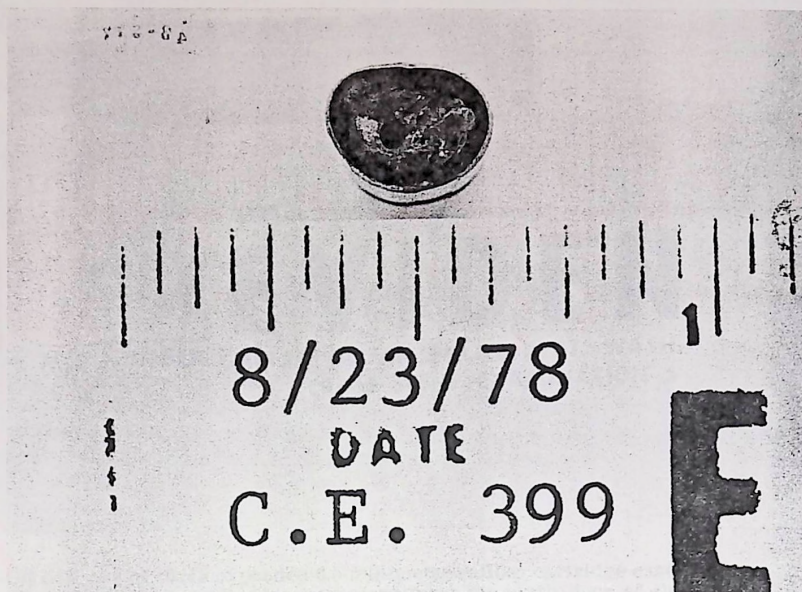


FIGURE 6B.—CE 399, the fired 6.5-millimeter caliber full metal-jacketed bullet found on a stretcher in the emergency area of Parkland Memorial Hospital, view of the base portion, showing distortion.

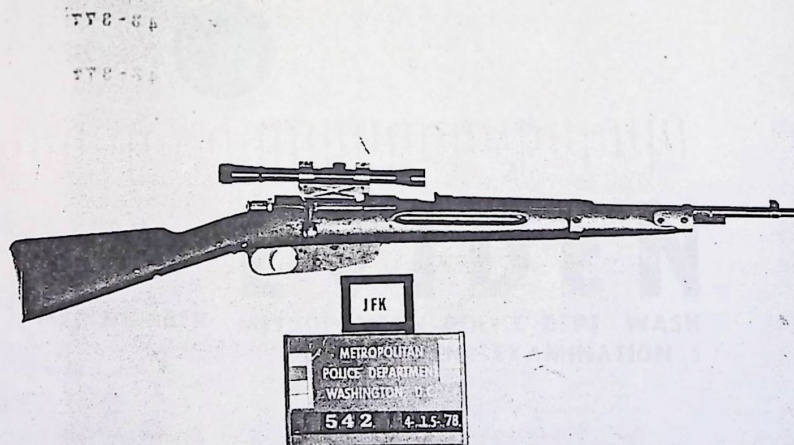
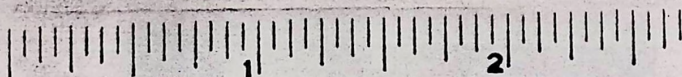


FIGURE 7.—CE 542, a 6.5-millimeter caliber Mannlicher-Carcano rifle, serial No. UC 5209, purchased by the FBI for comparison purposes.



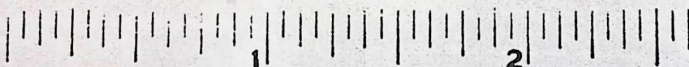
DATE
4-15-78

MCL NUMBER
CE 543

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METROPOLITAN POLICE DEPT. WASH.
CRIME SCENE EXAMINATION 5

FIGURE 8A.—CE 543, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, side view.



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MCL NUMBER
CE 543

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CRIME SCENE EXAMINATION 5

FIGURE 8B.—CE 543, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, top view. Note the dent on the mouth of the case.

772-64

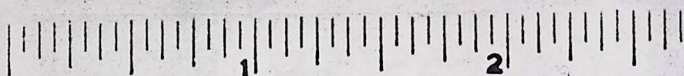
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CE 544METROPOLITAN POLICE DEPT. WASH.
CRIME SCENE EXAMINATION SI

FIGURE 9.—CE 544, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, side view.

772-65

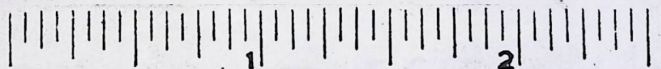
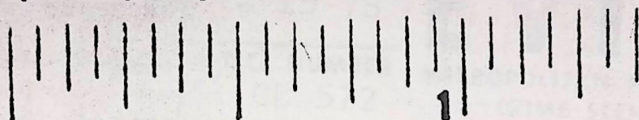
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CE 545METROPOLITAN POLICE DEPT. WASH.
CRIME SCENE EXAMINATION

FIGURE 10.—CE 545, one of three 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School

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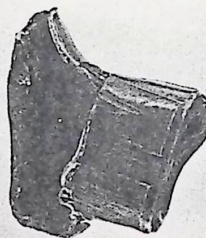
4-15-78 CE 567



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FIGURE 11.—CE 567, the nose portion of a fired 6.5-millimeter caliber metal-jacketed bullet found on the right side of the front seat of the Presidential limousine.

YTC-84



4-15-78 CE 569

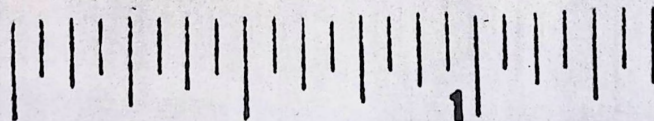
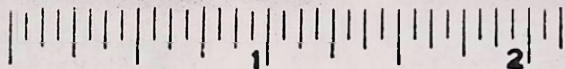


FIGURE 12.—CE 569, the base portion of a fired 6.5-millimeter caliber metal-jacketed bullet found on the floor next to the right front seat of the Presiden-



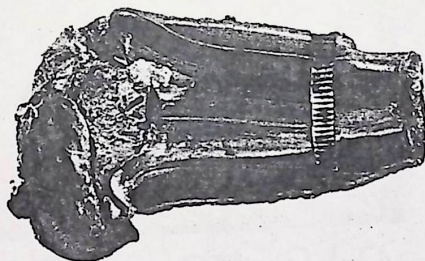
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CE 572

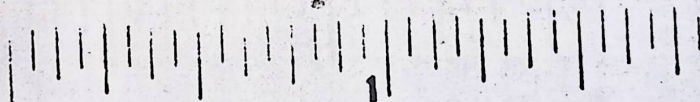
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FIGURE 13.—CE 572, two fired 6.5-millimeter caliber full metal-jacketed bullets, test-fired by the FBI from the CE 139 rifle and designated as K1A and K1B.



4-15-78 CE 573



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FIGURE 14.—CE 573, the 6.5-millimeter caliber metal-jacketed bullet recovered from the residence of General Edwin Walker.

575-84

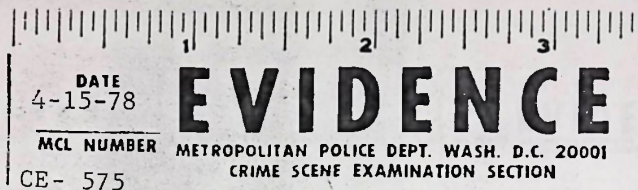
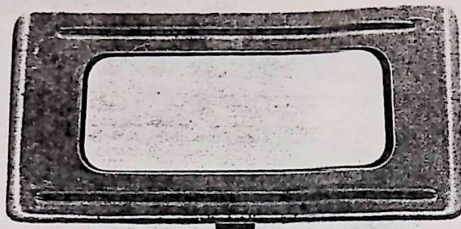


FIGURE 15.—CE 575, the brass cartridge clip removed from the CE 139 rifle.

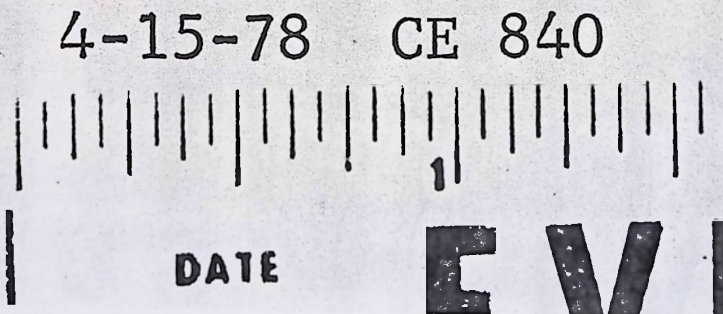


FIGURE 16.—CE 840, two lead-like fragments found underneath the left jump seat of the Presidential limousine.

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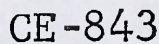
4-15-78 CE 42

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CRIME SCENT EXAMINATION SECTION

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FIGURE 18.—CE 843, three lead-like fragments removed from President Kennedy's brain during the autopsy.

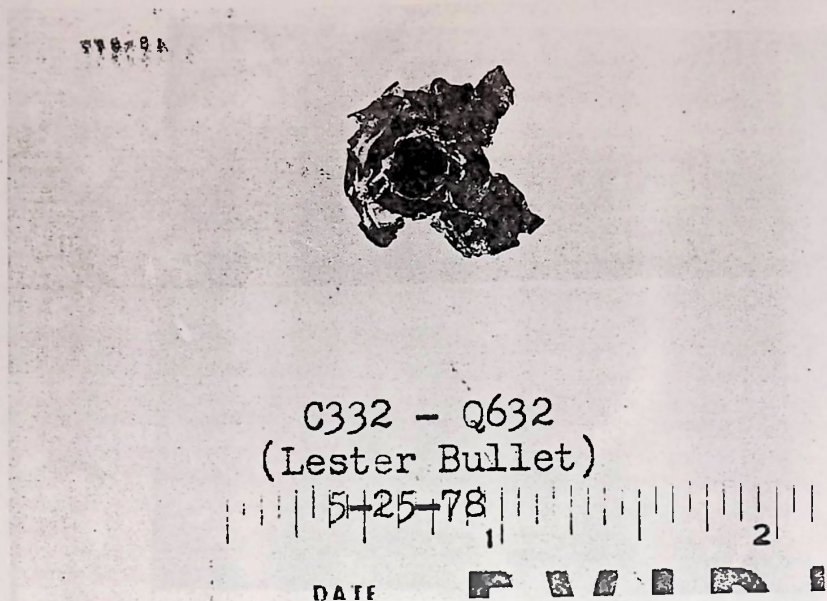
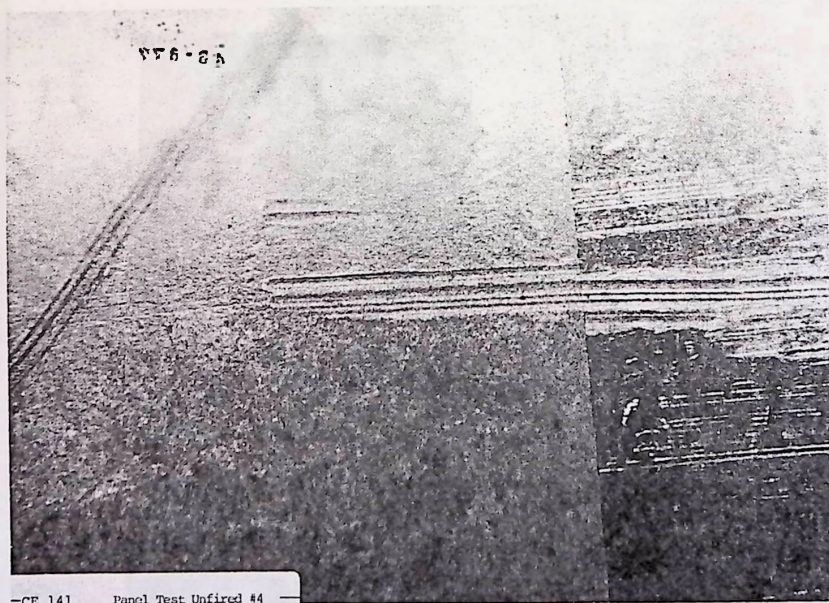


FIGURE 19.—The Lester bullet, a fired soft- or hollow-pointed, metal-jacketed bullet found in 1974 by Richard Lester about 500 yards from the depository near the Triple overpass.



—CE 141 Panel Test Unfired #4 —

FIGURE 20.—Photomicrograph showing the correspondence between the individual identifying characteristics on the side of the CE 141 cartridge (L) and on panel unfired test cartridge No. 4 (R), produced by the magazine follower of the 139 rifle.

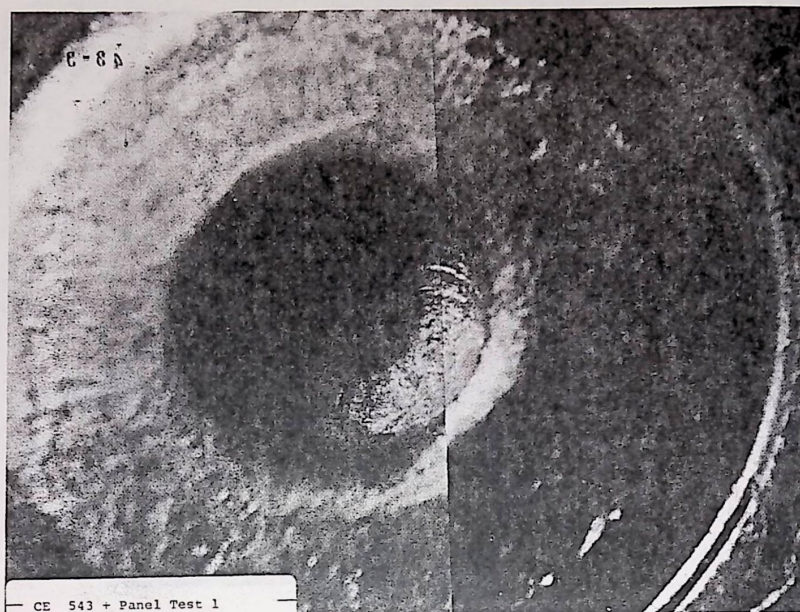


FIGURE 21A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 543 cartridge case (L) and on panel Kennedy T-1 (R), produced by the firing pin of the CE 139 rifle.

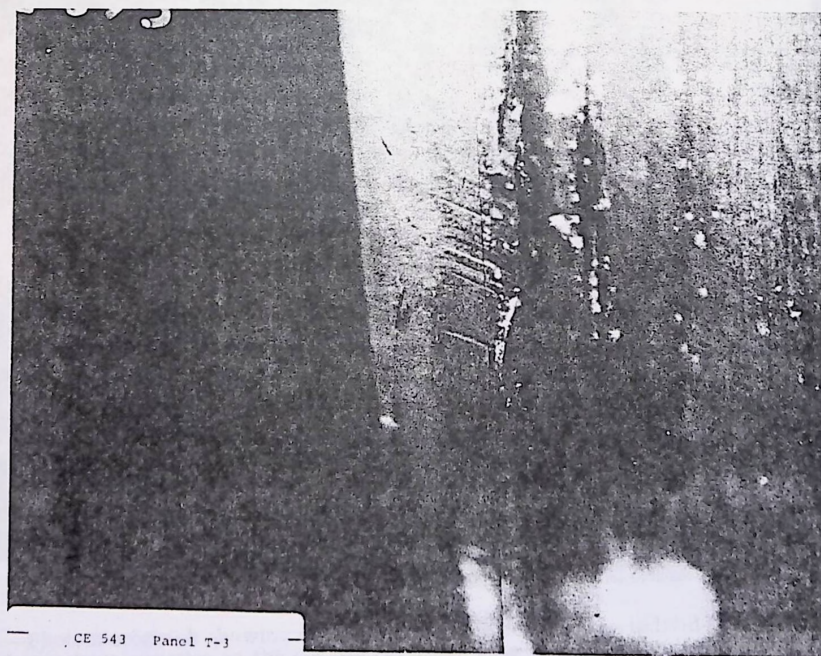
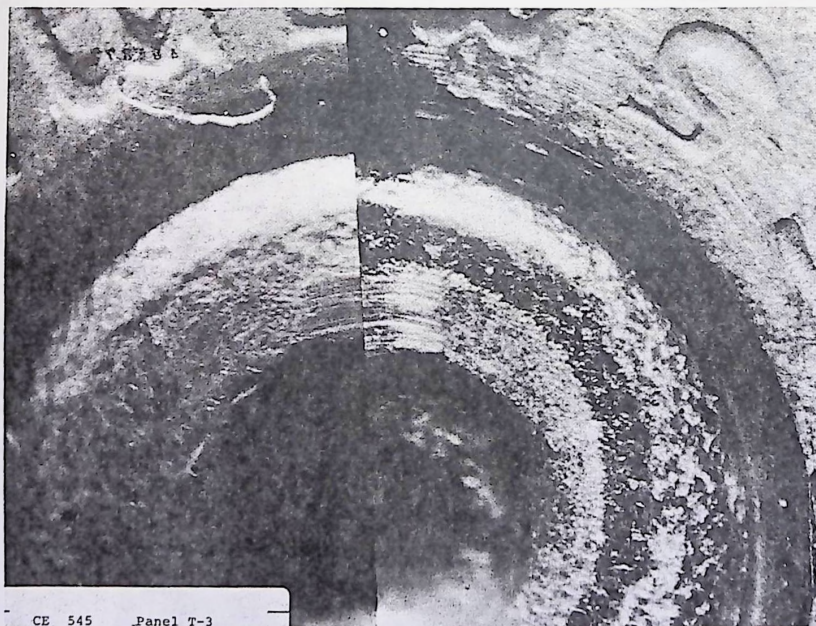


FIGURE 21B.—Photomicrograph showing the correspondence between the individ-



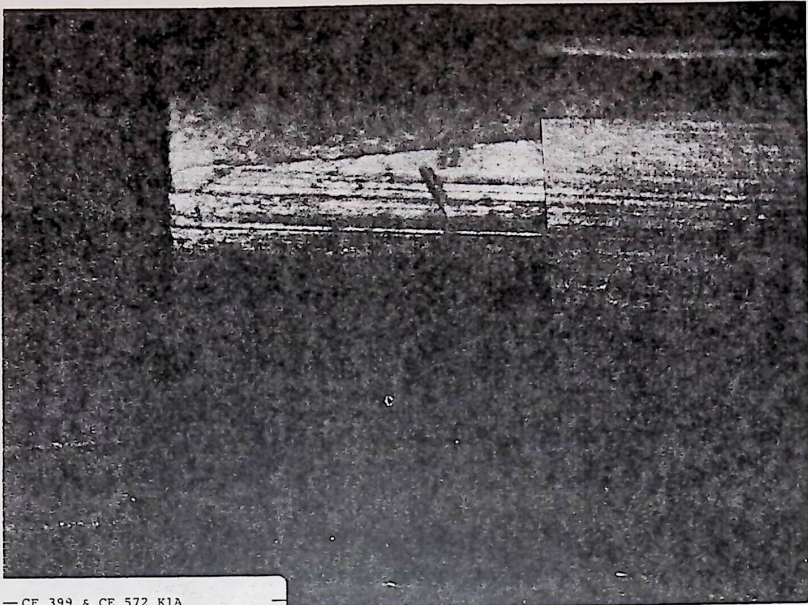
CE 544 Panel T-1

FIGURE 21C.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 544 cartridge case (L) and those on panel Kennedy T-1 (R) produced by the bolt face of the CE 139 rifle.



CE 545 Panel T-3

FIGURE 21D.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 545 cartridge case (L) and those on panel Kennedy T-3 (R), produced by the bolt face of the CE 139 rifle.



— CE 399 & CE 572 K1A

FIGURE 22A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 399 bullet (L) and those on CE 572-K1A bullet (R), test-fired by the FBI in the CE 139 rifle.

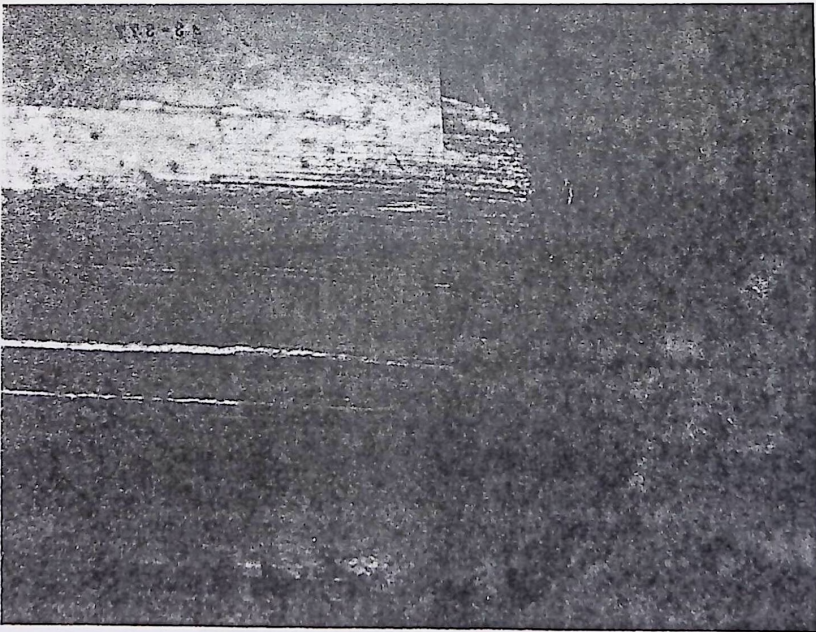
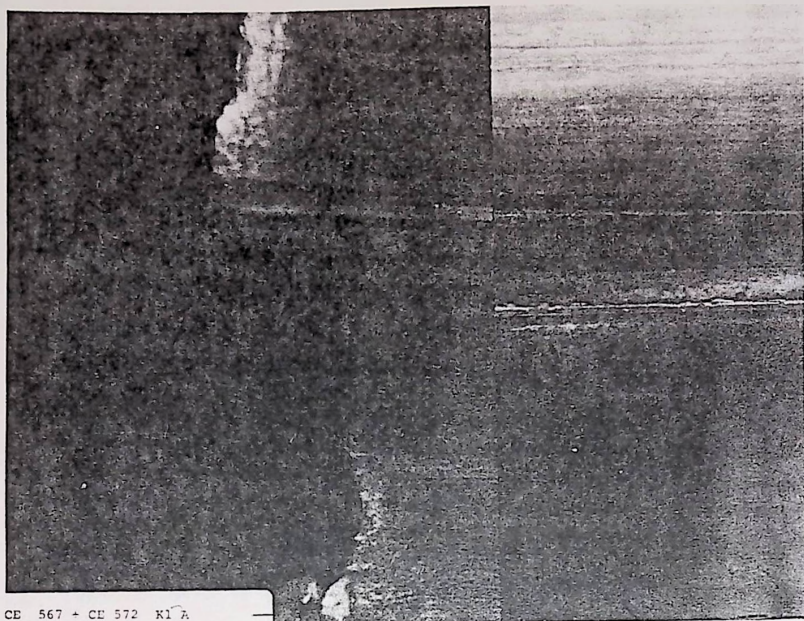
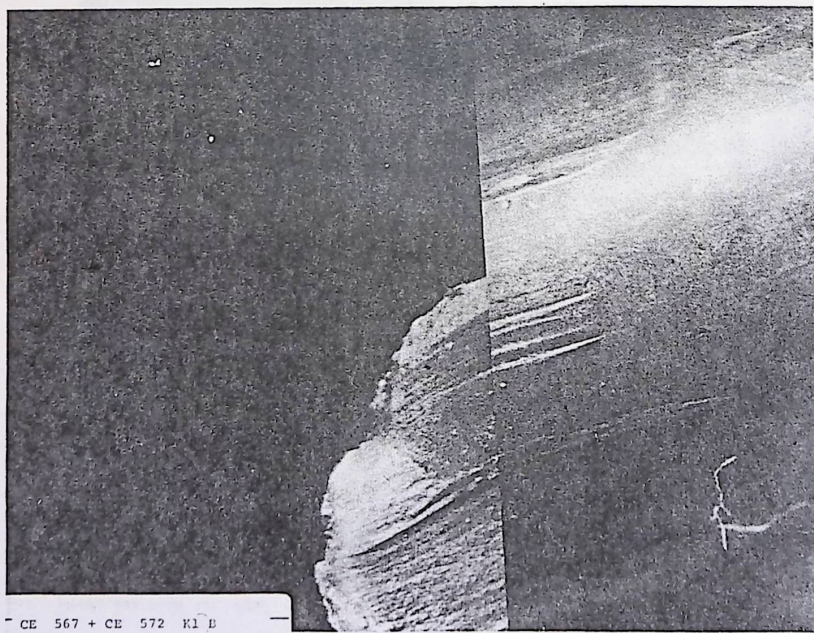


FIGURE 22B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 399 bullet (L) and those on the CE 572-K1A bullet (R), test-fired by the FBI in the CE 139 rifle.



CE 567 + CE 572 K1 A

FIGURE 23A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 567 bullet fragment (L) and those on CE 572-K1A (R), test-fired by the FBI in the CE 139 rifle.



CE 567 + CE 572 K1 B

FIGURE 23B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 567 bullet fragment (L) and those on CE 572-K1B (R), test-fired by the FBI in the CE 139 rifle.

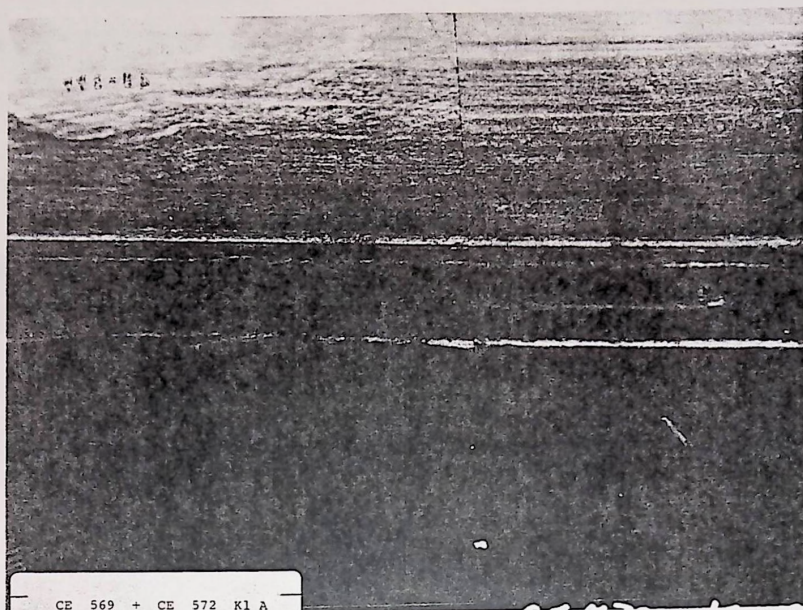


FIGURE 24A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 569 bullet fragment (L) and CE 572-K1A bullet (R), test-fired by the FBI in CE 139 rifle.

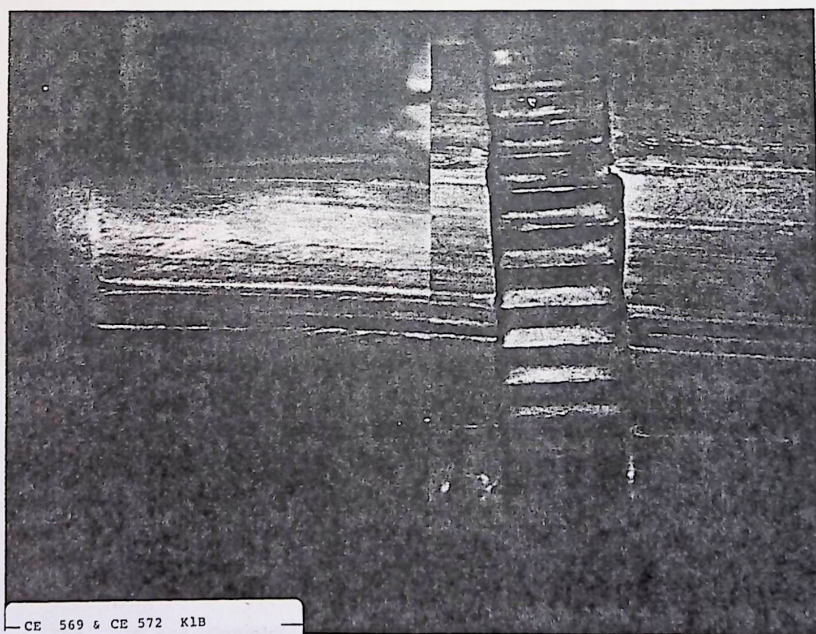


FIGURE 24B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 569 bullet fragment (L) and the CE 572-K1R bullet (R), test-fired by the FBI in the CE 139 rifle.

YTC-8A

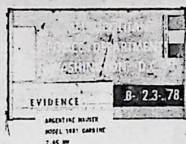
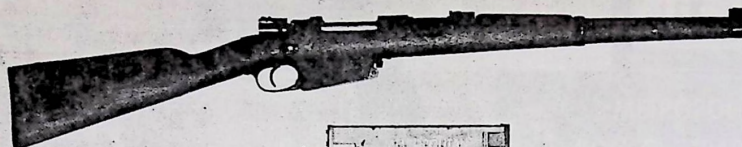


FIGURE 25.—A 7.65-millimeter caliber Argentine Mauser rifle, Model 1891.

YTC-8A

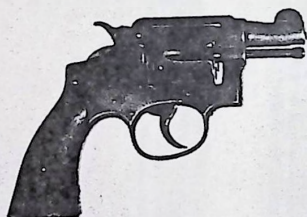


FIGURE 26A.—CE 143. Oswald's .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, right side.

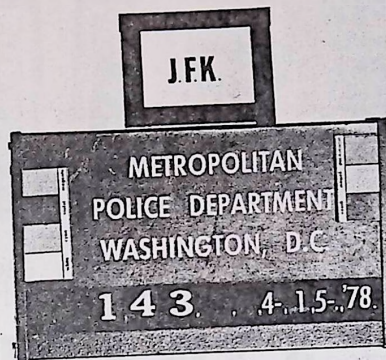


FIGURE 26B.—CE 143, Oswald's .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, left side.

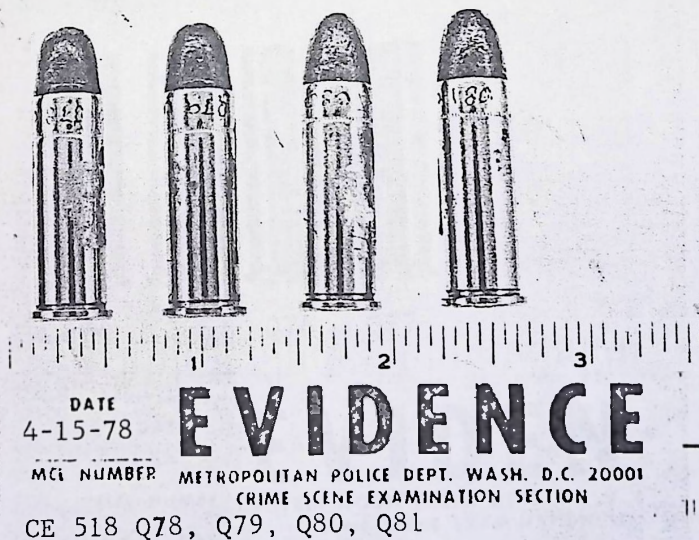
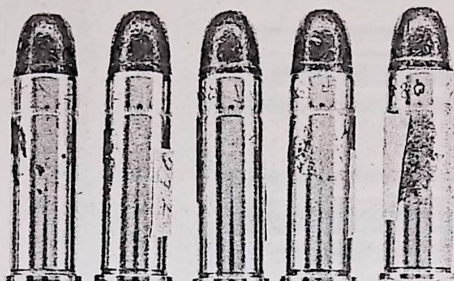


FIGURE 27.—CE 518, four .38 special caliber cartridges, designated Q78-Q81 by the FBI, found in Oswald's revolver. Q78 and Q79 have copper-coated (Tubaloy), lead, round-nose bullets; Q80 and Q81 have plain lead, round-nose bullets.

VVE-6A



Q82 Q83 Q84 Q85 Q86

DATE
4-15-78

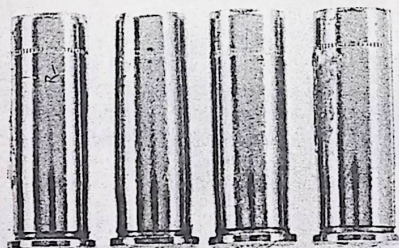
MCL NUMBER
CE 592

EVIDENCE

METROPOLITAN POLICE DEPT. WASH. D.C. 20001
CRIME SCENE EXAMINATION SECTION

FIGURE 28.—CE 592, five .38 special caliber cartridges of Western Cartridge Co. manufacture, with copper-coated (Lubaloy), lead, round-nose bullets, designated Q82-Q86 by the FBI. The cartridges were found in Oswald's trouser pocket.

VVE-6B



Q74 Q75 Q76 Q77

DATE
4-15-78

MCL NUMBER
CE 594

EVIDENCE

METROPOLITAN POLICE DEPT. WASH. D.C.
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FIGURE 29.—CE 594, four expended cartridge cases recovered from the scene of the Tippit murder, designated Q74-Q77 by the FBI. Q75 and Q76 of Western Cartridge Co. manufacture, Q74 and Q77 are of Remington Arms manufacture.

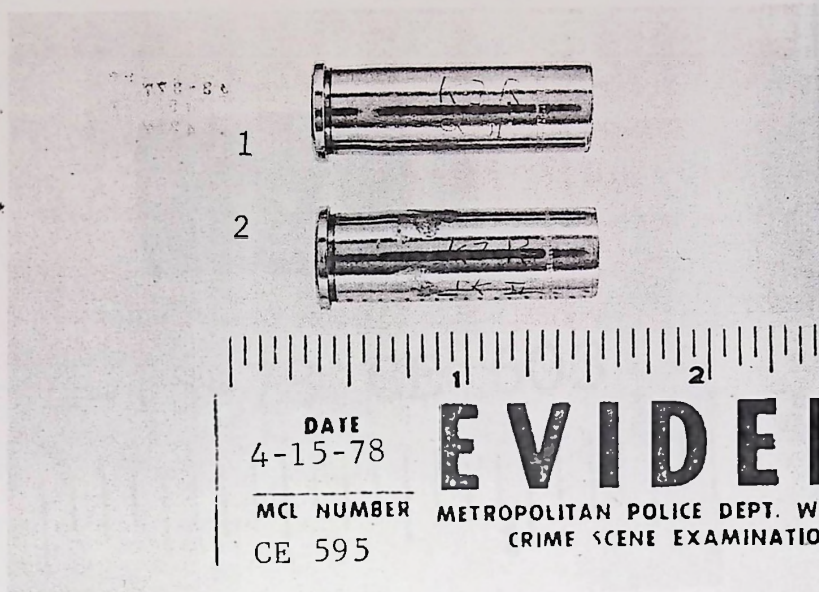


FIGURE 30.—CE 595, two cartridge cases, test-fired by the FBI in the CE 143 revolver. K3-1 is .38 special caliber of Winchester Repeating Arms manufacture. K3-2 is of Western Cartridge Co. manufacture; it has a split in the side, at the point of the bulge along the top side of the case.

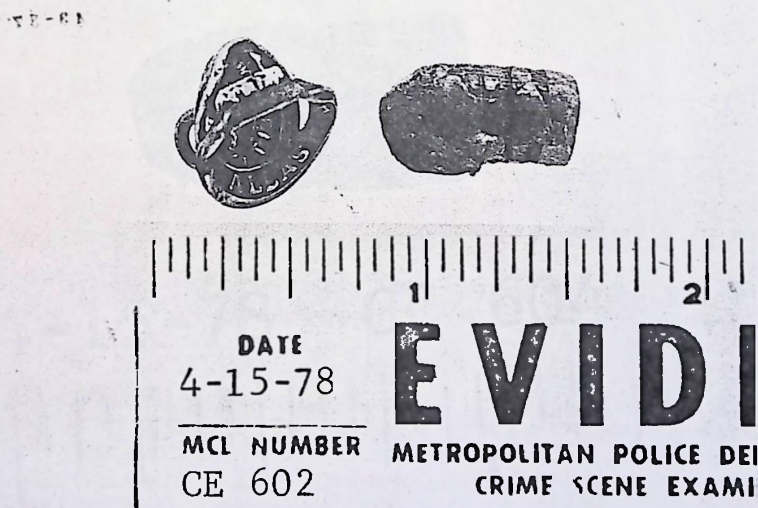


FIGURE 31.—CE 602, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, and one damaged brass-colored garment button with the lettering "City of Dallas," removed from the body of Officer Tippit. The bullet shows impact damage caused by striking the button and Officer Tippit's body.

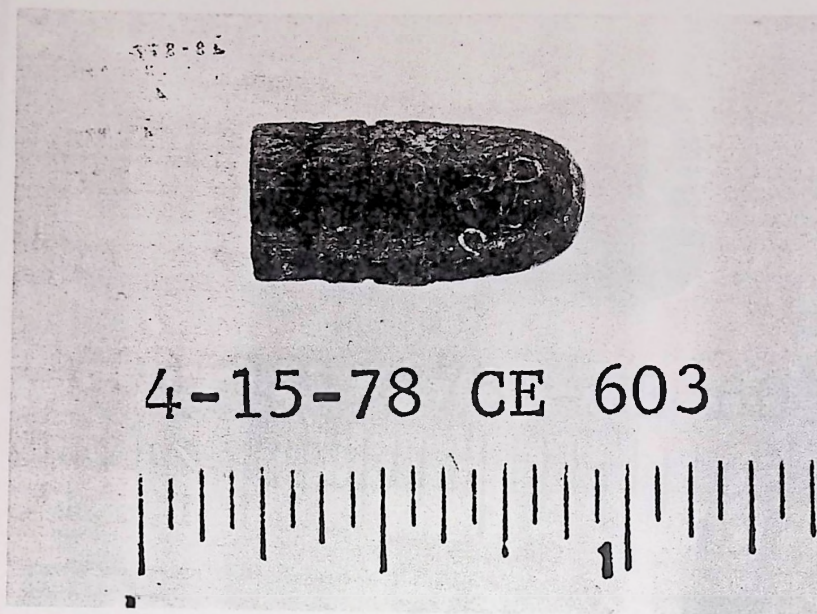


FIGURE 32.—CE 603, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, removed from the body of Officer Tippit.



FIGURE 33.—CE 604, one .38 special caliber lead, round-nose bullet, removed from the body of Officer Tippit.

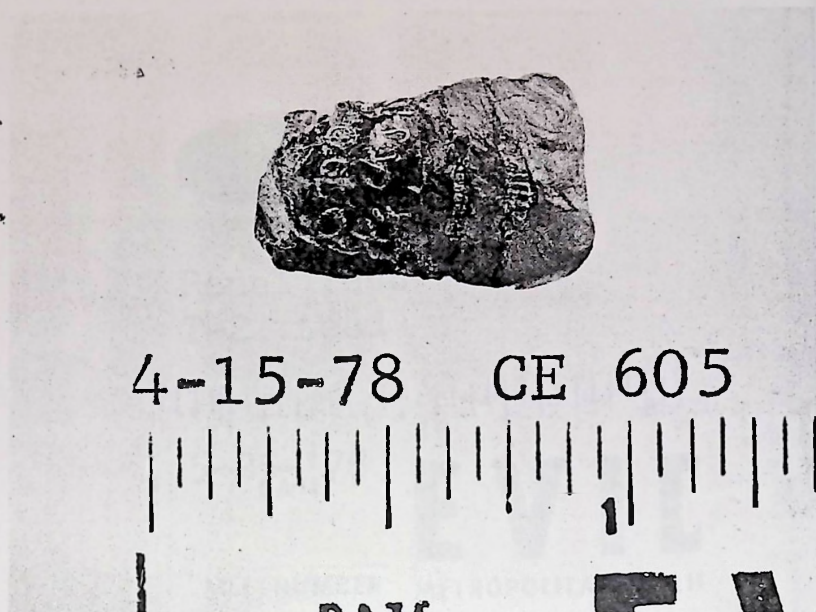


FIGURE 34.—CE 605, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, removed from the body of Officer Tippit.

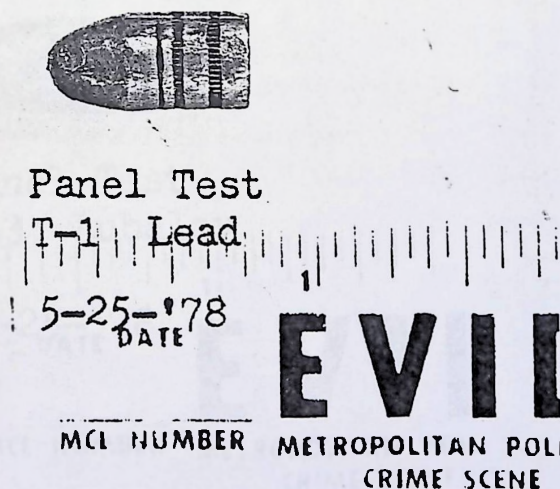


FIGURE 35A.—Panel Tippit T-1: One .38 special caliber lead bullet of Remington-Peters manufacture, test-fired from CE 139 by the panel into a horizontal water recovery tank.



Panel Test
T-2 Lead

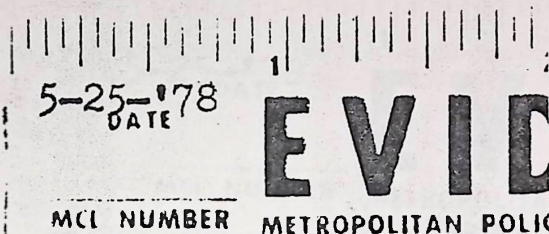


FIGURE 35B.—Panel Tippit T-2: one .38 special caliber lead bullet of Remington-Peters manufacture, test-fired from CE 143 by the panel into a horizontal water recovery tank.



Panel Test
T-3 Lubaloy

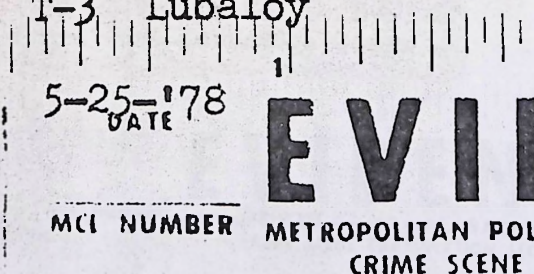


FIGURE 35C.—Panel Tippit T-3: 1 .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet of Western Cartridge Co. manufacture, test-fired from CE 143 by the panel into a horizontal water recovery tank.



Panel Test

T-4 Lubaloy

5-25-'78
DATE**EVID**MCI NUMBER METROPOLITAN POLICE
CRIME SCENE EXAMINATION SECTION

FIGURE 35D.—Panel Tippit T-4: 1 .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet of Western Cartridge, Co. manufacture, test-fired from CE 143 into a horizontal water recovery tank.

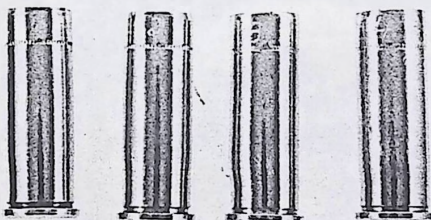
T-1 T-2 T-3 T-4
Panel Test Cartridge Cases5-25-'78
DATE**EVIDENCE**MCI NUMBER METROPOLITAN POLICE DEPT. WASH. D.C. 2001
CRIME SCENE EXAMINATION SECTION

FIGURE 35E.—Panel Tippit T-1—T-4: Four expended .38 special caliber cartridge cases. Tippit T-1 and T-2 are of Remington-Peters manufacture; Tippit T-3 and T-4 are of Western Cartridge Company; all are fired in the CE 143 revolver.

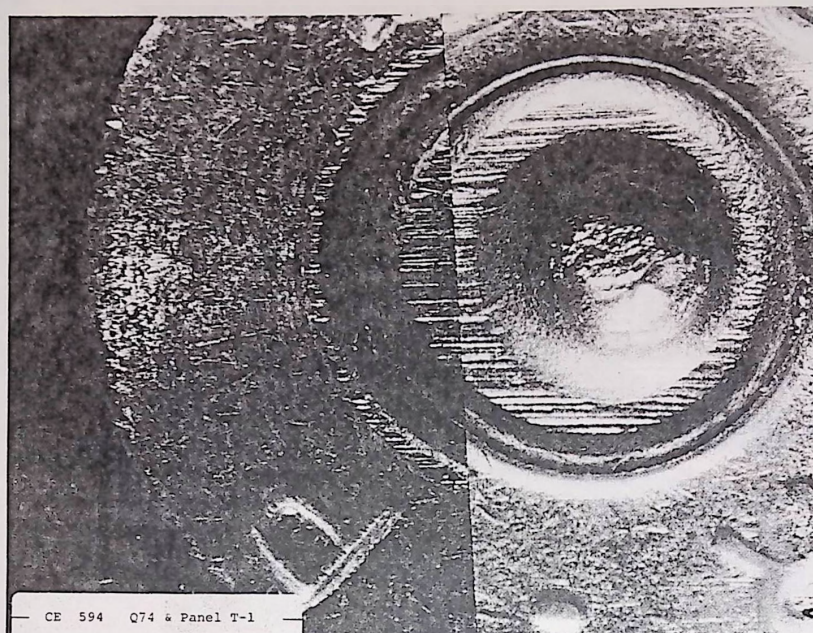


FIGURE 36A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q74) cartridge case (L) and the panel Tippit T-1 cartridge case (R), produced by the breech face of the CE 143 revolver.

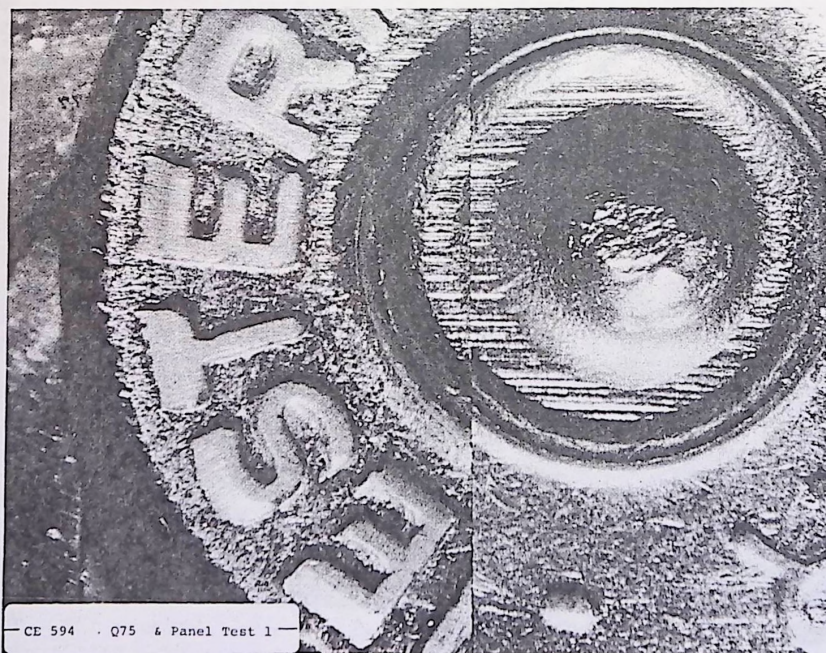


FIGURE 36B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q75) cartridge case (L) and the panel Tippit T-1 cartridge case (R), produced by the breech face of the CE 143 revolver.

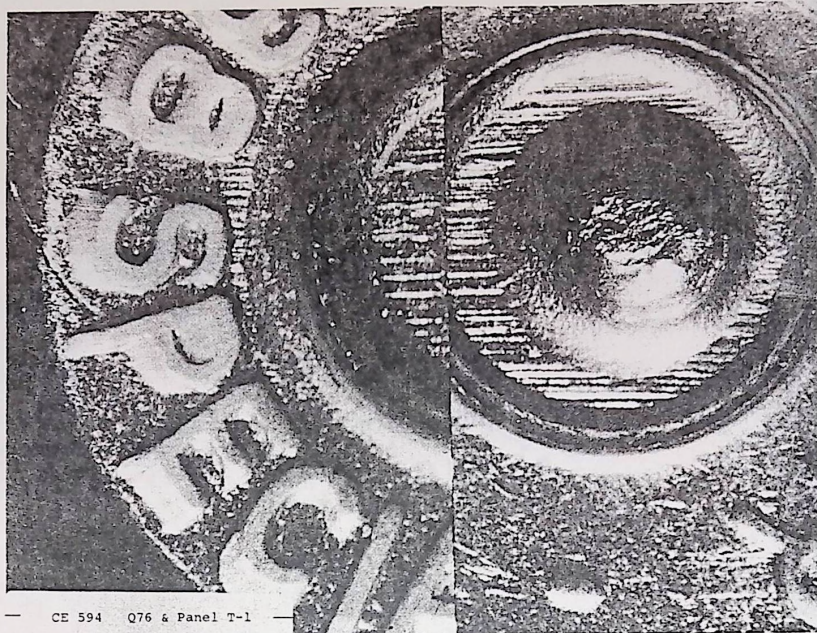


FIGURE 36C.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q76) cartridge case (L) and the Tippit T-1 cartridge case (R), produced by the breech face of the CE 143 revolver.

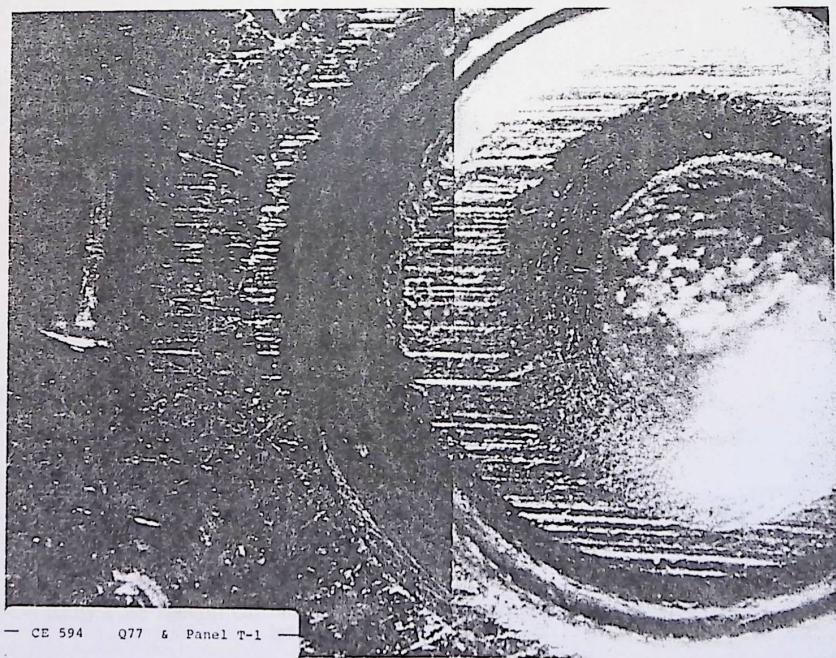


FIGURE 36D.—Photomicrograph showing the correspondence between the indi-



FIGURE 37A.—Ruby's .38 special caliber Colt Cobra revolver, serial. No. 2744 LW, right side.

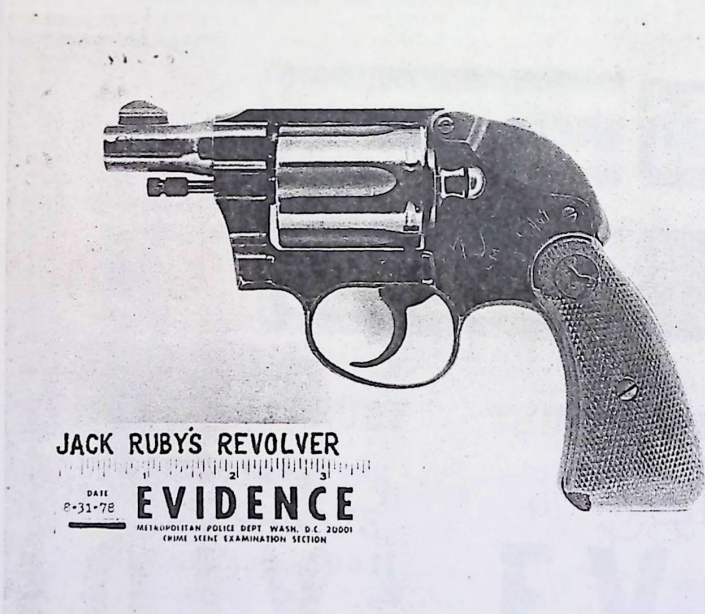
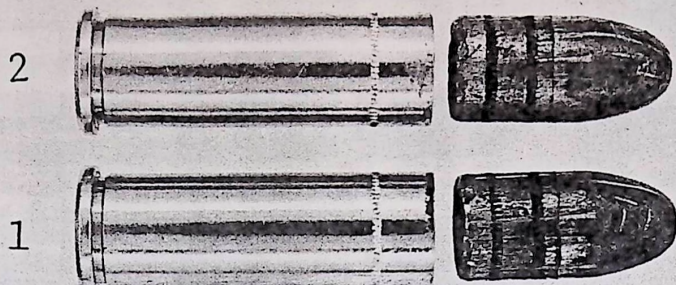


FIGURE 37B.—Ruby's .38 special caliber Colt Cobra revolver, serial No. 2744, LW, left side.



J. RUBY

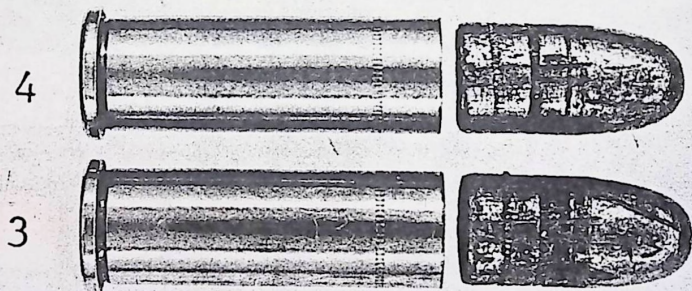
TEST #1 & 2

9-6-78

DATE

EVID

FIGURE 38A.—Panel Ruby T-1 and T-2: Two .38 special caliber cartridges of Remington-Peters manufacture, with 158-grain, lead, round nose bullets, test-fired by the panel from Jack Ruby's revolver into a horizontal recovery tank.



J. RUBY

TEST #3 & 4

9-6-78

DATE

EVID

FIGURE 38B.—Panel Ruby T-3 and T-4: Two .38 special caliber cartridges of Western Cartridge Co. manufacture, with 158-grain, copper-coated (Lubaloy), lead, round nose bullets, test-fired from the Jack Ruby's revolver into horizontal recovery tank.

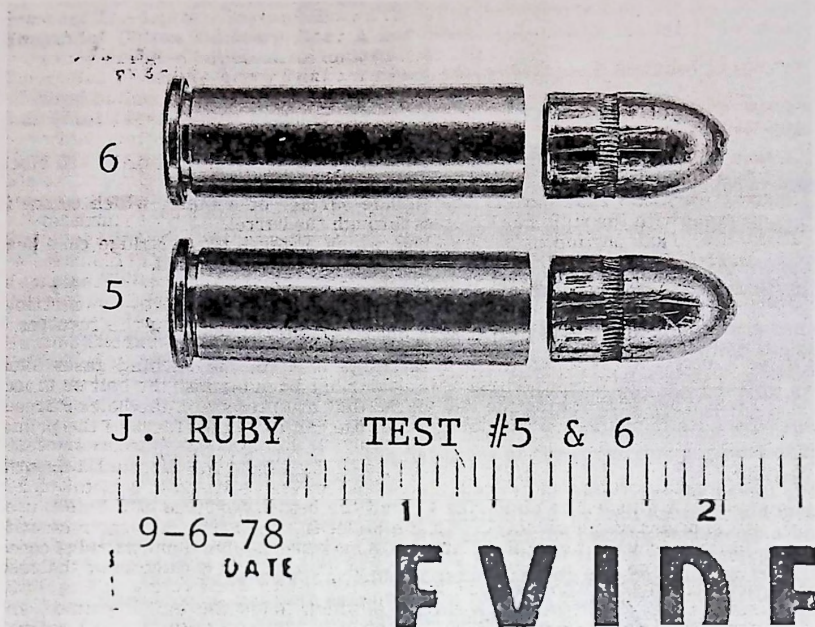


FIGURE 38C.—Panel Ruby T-5 and T-6: Two .38 special caliber cartridges of Remington Arms Co. manufacture, with 130-grain, full metal-jacketed, round nose bullets, test-fired by the panel from Jack Ruby's revolver into a horizontal water recovery tank.

GLOSSARY

- Action:** The heart of any firearm. It consists of the receiver, bolt or breech block, * feed and firing and unloading mechanisms.
- Bearing Surface:** That part of the outside surface of a bullet which comes in contact with the rifling as it passes through the barrel.
- Bolt Face:** That portion of a rifle's bolt which engages the cartridge case head and from which the firing pin protrudes when the rifle is fired.
- Bore:** The interior of the barrel of a firearm.
- Breech Face:** In revolvers, the area of the frame which supports the cartridge case head and through which the firing pin protrudes when the revolver is fired.
- Breech Face Impressions:** When a cartridge is fired, the burning gases exert pressures that force the base of the cartridge back against the bolt or breech face. When this occurs, the tool marks that are present on the bolt or breech face are imprinted on the flat areas of the contacting surfaces of the primer and cartridge case base.
- Bullet:** That part of a cartridge intended to be fired from the barrel of a firearm. It is usually composed of lead, plated lead or lead encased in a metal jacket.
- Cannelure:** A knurled or plain ring around the bearing surface of a bullet, used to hold surface lubricant, retain the bullet in the cartridge case or identify the type or weight of bullet. Cannelures may also be found on cartridge cases.
- Cartridge:** A complete assembly of a round of ammunition consisting of the case, primer, propellant powder, and bullet.
- Cartridge Case:** That part of a cartridge which holds the bullet, primer, and propellant powder together.
- Cartridge Clip:** A device for holding a number of cartridges to permit their easy insertion into a magazine. The Mannlicher-Carcano clip remains in the magazine until after the last cartridge is fed into the chamber, at which time it is designed to fall through the bottom opening of the magazine.
- Chamber:** In a rifle, the rear portion of the barrel, designed to hold and support a cartridge. In a revolver, it is also the recess cut into the cylinder to hold each cartridge.
- Chambering:** The manual or mechanical process of feeding a cartridge into the chamber of a firearm.
- Comparison Microscope:** A scientific instrument designed to allow the similarity, or dissimilarity, of individual identifying characteristics of two bullets or two cartridge cases to be observed at the same time.
- Cylinder:** A rotating cartridge container in a revolver.
- Double Action:** The mode of firing a revolver in which the hammer of the firearm is cocked and released by a single pull of the trigger.
- Eject:** The act of throwing the expended cartridge case clear of the action during the firing process.
- Emission Spectrography:** Allows the metallic composition of samples to be compared so that the possibility of common origin can be determined. This is done by subjecting the material to intense heat and comparing the color of gases emitted.
- Extract:** The process of withdrawing an expended cartridge case or unfired cartridge from the chamber of a firearm, either by mechanical or manual means.
- Firearms Identification:** A study of firearms, bullets, cartridge cases and other ammunition components with the purpose of identifying those ammunition components as having been fired from, or in, a particular firearm to the exclusion of all other firearms.
- Firing Pin:** That part of a firing mechanism which strikes the primer.
- Firing Pin Impression:** The indentation caused by the firing pin striking the primer of the cartridge case.
- Gas Erosion:** The wear caused by the action of the hot propellant powder gases on the bearing surface of a bullet.

- Grooves*: The depressed areas between the lands of a rifled barrel.
- Horizontal Cotton Recovery Box*: A box, filled with cotton material, designed to recover fired bullets in an undamaged condition.
- Horizontal Water Recovery Tank*: A metal, water-filled tank designed to recover fired bullets in an undamaged condition.
- Individual Identifying Characteristics*: Unique reproducible microscopic marks which can be used to identify a fired bullet or expended cartridge case with a particular firearm.
- Lands*: The raised areas between the grooves of a rifled barrel.
- Loading Ramp*: A device that aids in guiding a cartridge into the chamber of a firearm.
- Magazine*: A device, either separate or integral to the firearm, in which cartridges are held in position to be fed into the chamber of the firearm.
- Magazine Follower*: (In footnotes).
- Microscopic Examination*: An examination of evidence which is enhanced by the use of scientific instruments.
- Muzzle*: The forward end of the barrel where the bullet exits.
- Neutron Activation Analysis*: A method of nuclear elemental analysis in which samples are irradiated to make their various elements detectable by radioactive measurement. The elemental composition of the activated samples is then compared to determine the probability of common origin.
- Photomicrograph*: Photograph taken through a microscope.
- Primer*: The ignition part of a cartridge.
- Rechambering*: The process of altering the dimensions of a chamber to accommodate other cartridges.
- Recrowning*: The process of restoring the rounded contour to the muzzle after the barrel has been shortened.
- Reset*: (See footnotes).
- Rifling*: The spiral lands and grooves in a barrel which impart spin or rotation to the bullet stabilizing it in flight.
- Rifling Class Characteristics*: The number, width and direction of twist of the lands and grooves in a barrel.
- Sear Mechanism*: The part or device designed to hold the firing mechanism in a cocked position until released by pressure on the trigger.
- Secondary Missiles*: Objects put in motion due to the impact of a bullet.
- Single Action*: The mode of firing a revolver that requires that the hammer be manually cocked before it can be fired.
- Spectrographic Analysis*: See "Emission Spectrography".
- Striations*: Minute grooves, ridges or scratches normally running parallel with each other that are caused by an abrasive action.
- Tool Mark*: Characteristics of a surface imparted to a softer surface when they come in contact under pressure and motion. Tool marks may be impressed or engraved.
- Trigger Pull*: The amount of force, expressed in pounds, required to release the firing mechanism.
- Twist*: The spiral direction of lands and grooves in a rifled bore, expressed as right or left.
- Visual Examination*: Examination of evidence without the assistance of a scientific instrument; also referred to as macroscopic examination.
- Wiping*: The removal of some of the fine microscopic scratches on a bullet, particularly the lead variety, as it enters and passes through fabric, heavy tissue and muscle.

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- (5) WCH, vol. 3, p. 293.
- (6) Ibid.
- (7) WCH, vol. 24, p. 228.
- (8) WCH, vol. 4, p. 260.
- (9) Id. at p. 258.
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- (11) Warren report, p. 165.
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- (15) Id. at p. 474.
- (16) Id. at p. 301.
- (17) Ibid.
- (18) Id. at p. 460.
- (19) Id. at p. 459.
- (20) Id. at p. 460.
- (21) WCH, vol. 3, p. 301.
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- (26) WCH, vol. 5, p. 72.
- (27) Ibid.
- (28) Id. at p. 73.
- (29) Id. at p. 66.
- (30) Id. at p. 67.
- (31) Ibid.
- (32) Id. at p. 66.
- (33) Ibid.
- (34) WCH, vol. 3, p. 435.
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- (36) WCH, vol. 3, p. 452.
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- (41) WCH, vol. 3, p. 497.
- (42) Warren report, p. 85.
- (43) WCH, vol. 5, pp. 67, 73, and 74.
- (44) Warren report, p. 85.
- (45) Ibid.
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- (68) Ibid.
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- (71) The "CE" designations of the Warren Commission were used by the panel.
- (72) The panel noted that Warren Commission determined the weight of CE 399 to be 158.6 grains (Warren report, p. 95). The National Archives also weighed CE 399, at the request of the committee and the panel, on Dec. 14, 1978, and found its weight to be 157.7, the same as the panel's finding (HSCA outside contact report, Robert MacClaren, Dec. 14, 1978, JFK Document No. 013672).
- (73) HSCA incoming correspondence, National Archives, July 8, 1970 (JFK Document No. 010170).
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