III. The Assassin

*A. The Alleged Assassination Weapon**

1. INTRODUCTION

(186) The Warren Commission concluded that CE 139, a Mannlicher-Carcano rifle, was used to assassinate President Kennedy. (*65*) This rifle was linked by the Commission to Lee Harvey Oswald by both fingerprint and cloth fiber analysis, and by two photographs taken in Oswald's backyard that depict him holding the weapon. (*66*) These findings, however, have been questioned on the basis of observations relative to postassassination photographs of the alleged murder weapon.

(187) It has been observed that when various postassassination photographs of the rifle are enlarged, so that the images of the rifle are the same length, the respective images do not coincide. One picture may show the rifle as having a longer barrel and shorter stock than another photograph, and frequently the component parts do not aline. (*67*) The Photographic Evidence Panel was asked to address this issue and to attempt to determine whether CE 139 could be photographically linked to Lee Harvey Oswald.

2. ISSUES

(188) *a.* Are the dimensions of CE 139, the alleged murder weapon that is in the National Archives, consistent with the dimensions of the rifle that Oswald is shown holding in the backyard pictures and with the alleged murder weapon, purportedly seized by the Dallas Police Department after the assassination, that is shown in numerous postassassination photographs?

(189) *b.* Can CE 139 be established to be both the same weapon that Oswald is shown holding in the backyard pictures and that was the subject of numerous postassassination photographs?

3. MATERIALS AND PROCEDURES

(190) The Photographic Evidence Panel reviewed the analysis that asserted that the relative dimensions of the rifle(s) depicted in these photographs were inconsistent, and perceived immediately that this analysis failed to consider the effect of perspective on the manner in which an image is depicted in a photograph. The camera lens projects an image of the three-dimensional world onto a two-dimensional film plane. This projection usually causes parallel lines in space to be

* This section was prepared under the direction of C. S. McCamy and Cecil W. Kirk; technical appendices by McCamy and Kirk are included. For related public hearing testimony, Sept. 14–15, 1978, see HSCA–JFK Hearings, vol. II, pp. 349, 397.

imaged as converging lines, and causes equally spaced intervals on a line that recedes from the camera to be imaged progressively shorter along the receding line.

(191) When a long object, such as a rifle, is tilted toward the camera axis so that one end is farther away than the other, the nearer parts are imaged larger relative to the central parts and the more distant parts are imaged smaller. The degree of difference depends on the angle of tilt. This effect is illustrated in figure III–1. (JFK exhibit F–389). Where the rifle is represented by a straight line and the camera is represented by the two essential parts, the lens and the film. Point A is at one end of the rifle, point B is at the center, and point C is at the other end. The size of the image can be found by assuming that light passes straight through the center of the lens. (*68*) Light from A goes to A′, from B to B′, and from C to C′. Figure III–1 demonstrates that although the length from A to B equals the length from B to C, the length from A′ to B′ is less than half the distance from B′ to C′. The photographic effect of tilt attributable to perspective is further demonstrated by figure III–2 (JFK exhibit F–207.) where five photographs of one particular rifle depict its relative dimensions differently, depending on the manner in which the weapon was tilted.

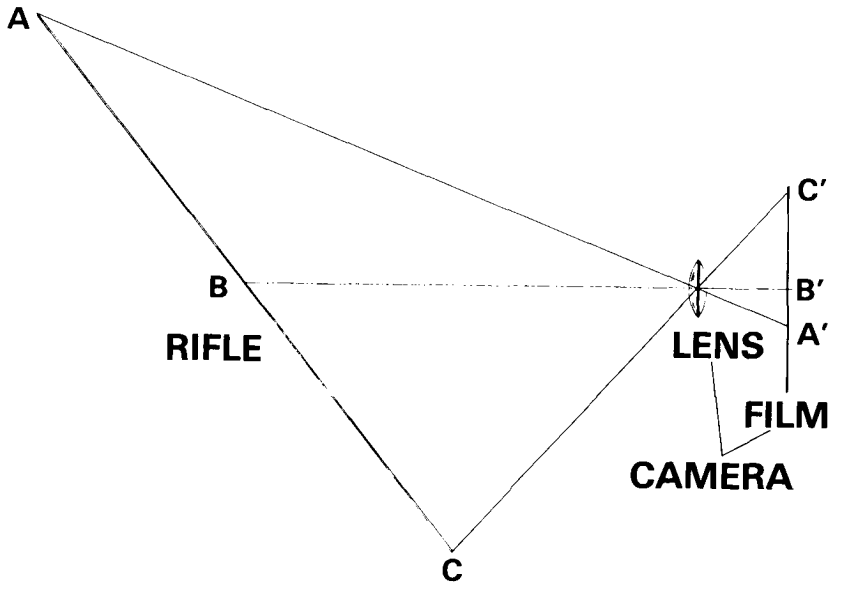

FIGURE III–1.—Photographic effect of rifle tilt.

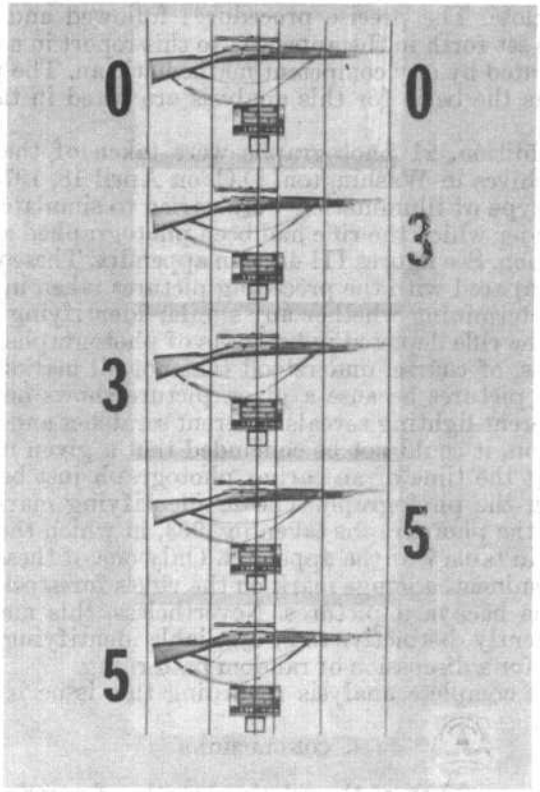

FIGURE III–2.—Effect of rifle tilt on apparent length.

(192) Realizing that the failure to consider the effect of tilt was probably responsible for the observed discrepancies, the Photographic Evidence Panel conducted a study that took the tilt factor into account. In this study the tilt angle, distance from rifle to lens and distance from lens to film* were found that would bring the images of the two ends of the rifle and the rear flat of the rear sight into conformance with the proportions of the Archives rifle. Then, using the same constants, the locations of 10 other points on the rifle were computed from distances measured on the photographs. The two end points of the rifle and the rear sight served as anchor points for the calculation, and consequently were not regarded as measured values. Ten other points were measured for each of 12 photographs on which the points were visible. The mean value was computed for each point. The average deviation of the values from the mean of each point was computed, and the deviation of the mean value from the value for the Archives rifle was computed.

(193) When the tilt was thus taken into account, the proportions of all the rifles photographed matched the proportions of CE 139

*These factors provided the mathematical basis for photogrammetric computations that brought these photographic images of the rifle into proportional conformance with the Archives rifle.

remarkably close. The precise procedures followed and calculations employed are set forth in the appendix to this report in a manner that can be duplicated by any competent mathematician. The photographs that served as the basis for this analysis are listed in table 1 of the appendix.

(194) In addition, 21 photographs were taken of the rifle in the National Archives in Washington, D.C. on April 18, 1978. The point of view and type of illumination were varied to simulate some of the conditions under which the rifle had been photographed at the time of the assassination. See figures III 4a–u in appendix. These photographs were then compared with the preceding pictures taken in 1963 for the purpose of determining whether any similar identifying marks could be found on the rifle depicted in both sets of photographs.

(195) It was, of course, understood that not all marks would show on all of the pictures because a given picture shows only one view. Further, different lighting reveals different scratches and other marks. For this reason, it could not be concluded that a given mark was not on the rifle at the time of an earlier photograph just because it was not visible on the photograph. The 22 identifying marks that were detected and the photographs taken in 1963, in which they are shown are set forth in table 7 of the appendix. Only one of these, the largest and most prominent, a gouge mark on the rifle's forestock, was visible on any of the backyard pictures. Nevertheless, this mark was considered sufficiently distinctive to be a reliable identifying feature. See addendum D for a discussion of random patterning.

The panel's complete analysis regarding this issue is set forth in the appendix.

4. CONCLUSIONS

(196) *a.* A comparison of the relative lengths of parts of the alleged assassination rifle that is in the National Archives with corresponding parts of what purports to be that rifle as shown in various photographs taken in 1963 indicates that the dimensions of the rifle(s) depicted are entirely consistent. *b.* A comparison of identifying marks that exist on the rifle as shown in photographs today with marks shown on the rifle in photographs taken in 1963 indicates both that the rifle in the Archives is the same weapon that Oswald is shown holding in the backyard picture and the same weapon, found by Dallas police, that appears in various postassassination photographs.

ADDENDUM

Report on an Examination of Photographs of the Rifle Associated With the Assassination of President John F. Kennedy *

Introduction

(197) The alleged assassination weapon was the subject of many photographs. An hour or so after President Kennedy was shot and killed on November 22, 1963, the Dallas police found a rifle in the Texas School Book Depository.(*69*) The police photographed the rifle where it was found. During the search of the building, a 16-millimeter motion picture was taken by Thomas Alyea of television station

*This section was prepared under the direction of C. S. McCamy.

WFAA. This motion picture film depicts the rifle at the time that it was discovered by the police.(*70*) A police officer carried the rifle from the building and, as he walked east on Elm Street and across Houston Street, reporter Allen, of the Dallas Times Herald, took a series of about seven pictures in rapid succession.(*71*) As the rifle was carried through the halls of the police station, it was held overhead for reporters to see. Numerous photographs were taken at that time. During the investigation, both the Dallas police and the FBI photographed the rifle a number of times in their photography labs.(*72*)

(198) Among Oswald's personal effects, the police found photographs depicting Oswald standing in his backyard, holding a rifle that looked like the rifle found in the book depository. These photographs were among the evidence considered by the Warren Commission. (*73*)

(199) Since that time, a number of authors have reexamined the evidence and raised questions about the conclusions drawn by the Warren Commission. It has been observed that when some of these photographs are enlarged so that the various images of the rifle are the same length, the images do not coincide. The proportions of the lengths of images of component parts of the rifle do not match. See fig. III–5 (JFK F–208) [White exhibit]. One picture may show the rifle as having a longer barrel and shorter stock than another picture, or different components of the rifle simply do not align.(*74*)

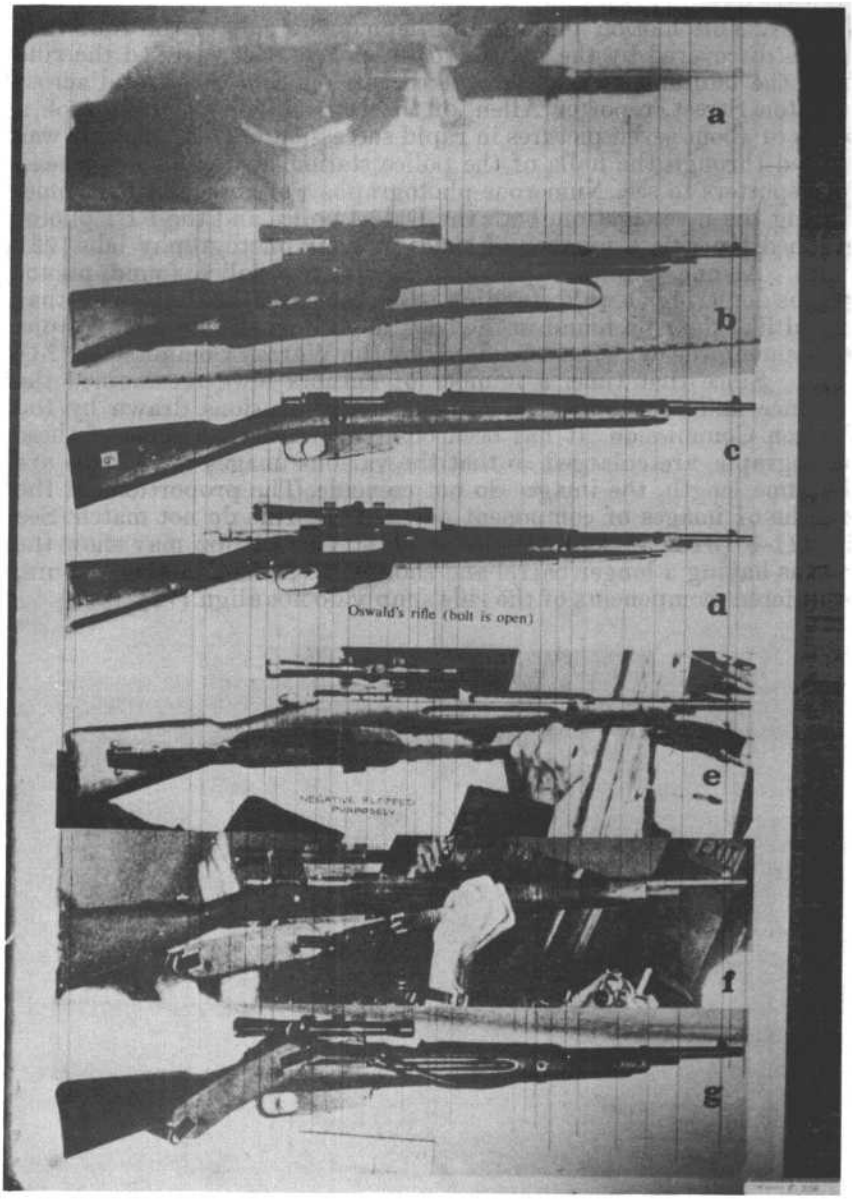

FIGURE III–5.—White Testimony Exhibit.

(200) Early in 1978, at the request of the committee, photographic panel member C. S. McCamy, undertook a study of this evidence. He studied two aspects of the evidence: (1) A comparison of the relative lengths of parts of the rifle, shown in various photographs taken in 1963, to the corresponding dimensions of the rifle now in the National Archives in Washington, D.C.; and (2) a comparison of identifying

marks shown on the photographs taken in 1963 with those shown on photographs he made of the rifle now in the National Archives. Both lines of investigation revealed facts that support the conclusion that the same rifle is depicted in all of the pictures examined. The study of proportions offers strong evidence that the rifle (or rifles) photographed is (or are) of the same kind. The comparison of identifying marks offers strong evidence that only one rifle is involved. The claims of gross mismatch are clearly refuted.

Relative Length Comparisons

(201) The artist knows that parallel lines in three-dimensional space must be depicted as converging lines on a two-dimensional representation, and that equally spaced intervals on a line must be depicted as progressively closer as the line recedes from the viewer. This kind of rendering is automatically performed by the camera lens. Nevertheless, the human visual system, involving both the eye and brain, interprets photographs as though they were objects in three-dimensional space. We rarely notice the rendering of perspective in pictures, as long as the pictures look natural.

(202) The various pictures of the rifle were taken at various angles. Viewed naturally, normal perspective causes parts of an object tilted towards the camera to appear lengthened relative to those parts that recede from the camera. See figure III–1 (JFK F–389) (rifle tilt). The extent to which this phenomenon occurs is a function of the degree to which the object, here a rifle, is tilted relative to the camera. Accordingly, in order to make a valid study of an object's relative length as depicted in photographs, the tilt factor attributable to perspective must be taken into consideration. This can be done using the same type of analysis that is employed in the making of maps.

(203) Most maps are now made by transferring measurements from aerial photographs. If the camera carried by the airplane is tilted with respect to the vertical direction, the effect of perspective must be taken into account. Thus, the matter dealt with here is an everyday problem, well understood by those who practice photogrammetry, the science of using photography to measure dimensions. (*75*)

(204) It would have been possible to have these measurement studies done by highly automated methods in a mapping agency of the U.S. Government, but to achieve the highest degree of acceptance and popular understanding of the methods, special simplified forms of photogrammetric equations were derived and are set forth in addendum A. All measurements on photographs were made with an ordinary millimeter scale and hand magnifier, and all calculations were performed with a commonly available pocket calculator having a memory and trigonometric functions. These mathematical derivations can be followed by a typical high school mathematics teacher, and all of the operations can be repeated by anyone with adequate patience and the intelligence to do calculations. The procedures are admittedly very laborious.

(205) The photographs that were the subject of this analysis are listed in table No. 1. With the exception of the picture taken by the Federal Bureau of Investigation, these pictures are enlarged prints of small negatives. The enlargement ratio or magnification of the enlarger M is the ratio of the length x' of an image on the enlarged pic-

ture to the length x of the corresponding image on the negative: $M=x'/x$. From this it follows that a distance on the negative x can be computed from the corresponding distance x' measured on the enlarged print and the magnification M by the following formula:

$$x=x'/M$$

The magnification of a contact print is 1.

(206) Since the objective is to compare lengths along the bore of the rifle or lines parallel to it, it is possible to work with the simple equation for computing distances along a straight line, rather than the more general three-dimensional photogrammetric equations. In practically all cases, the line of the rifle image passes nearly through the center of the picture and almost always the rear sight is near the center. Thus figure 6 is fairly representative. The derived equations also are valid if the rifle image is displaced from this central position. In that case, the image distance derived would not be the axial image distance,* [3] but the distance from the image of the rear sight to the rear nodal point * [2] of the lens. The computed proportions of the rifle would not be affected.

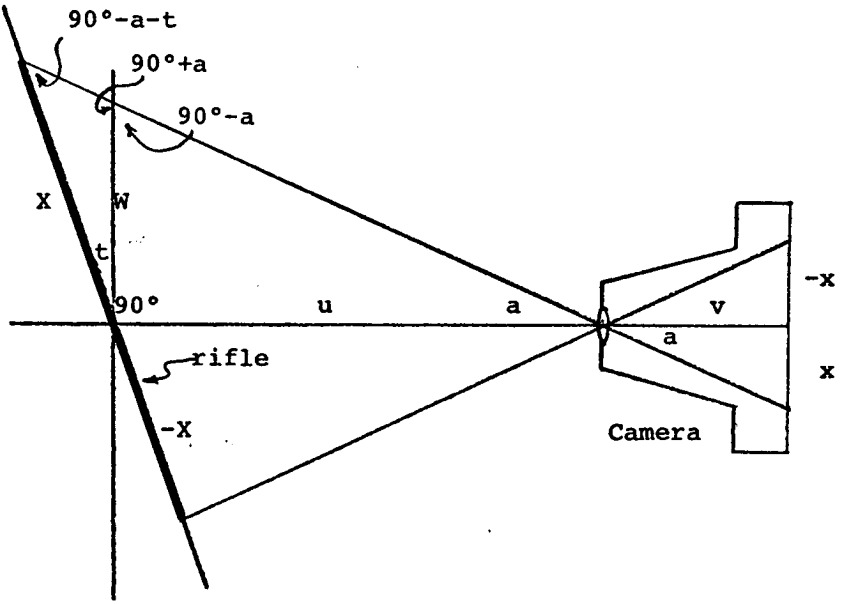

FIGURE III-6.—Geometric relationship of camera to the rifle titled at an angle t.

(207) As shown by the equations set forth in addendum A, when one point of an object is imaged at the center of a photograph, the actual distance X between that point and another point on the object may be calculated by measuring the corresponding distance x between

*These technical terms may be defined as follows:

[1] The optical axis is the line joining the center of the lens and the center of the image area.

these points on the photograph itself. This may be accomplished if we know the angle of title t between the linear object and a plane normal to the optical axis* [1] of the camera lens, the distance u from the center of the object to the front nodal point* [2] of the lens, the axial image distance v, and the distance from the rear nodal point of the lens to the camera image. The equation is:

$$X=\frac{ux}{v\cos t-x\sin t}$$

If we know u and the focal length* [4] of the lens, we can compute v, using the following equation:

$$v=uf/(u-f)$$

(208) In the present case, neither the distance u from the rifle to the camera lens, nor the angle of tilt t, nor the axial image distance v, is usually known. Most of the information needed to compute a distance X on the photographed rifle from a distance x on the negative is lacking. Nevertheless, the objective is not to compute such lengths; rather, it is to compare relative proportions of the parts of rifles photographed with the proportions of parts of the rifle in the Archives. To accomplish this, it is only necessary to scale the length of each rifle photographed to the length of the rifle in the Archives. The tilt angle t that makes the ratio of the length from the rear sight to muzzle and the length from rear sight to butt is the same as the corresponding ratio on the Archives rifle.* The tilt angle t is found by the following equation, which is based on the scaling described:

$$\tan t=\left(\frac{X_2}{x_2}-\frac{X_1}{x_1}\right)\frac{v}{X_2-X_1}$$

where: t is the tilt angle

X_2 is the length on the Archives rifle from rear sight to one end,
x_2 is the length on the negative image from rear sight to one end,
X_1 is the length on the Archives rifle from rear sight to the other end,
x_1 is the length on the negative image from rear sight to the other end,
and v is the axial image distance (lens to film)

The subscript 1 is assigned to the distance corresponding to the end of the rifle tilted away from the camera, and 2 is for the end tilted toward the camera. All measurements were from the vertical plane of the rear sight.

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[2] The front nodal point is the point of view from which the scene is imaged by the camera. The rear nodal point of the lens is the corresponding point in image space. The ray of light from the rear nodal point of the lens to an image point is parallel to the ray from the corresponding object point to the front nodal point of the lens.

[3] The axial image distance is the distance along the optical axis from the rear nodal point of the lens to the center of the image area.

[4] The focal length is the axial image distance when the camera is focused on an infinitely distant object.

*It may be mistakenly argued that this analysis seems to take for granted that to be proven because the angle that is found makes the 2 ends and the middle of the rifle image correspond to the proportions of the rifle in the Archives. Nevertheless, once the angle of tilt and the distances are found, 10 other distances are computed using the same equation. The degree to which these 10 distances correspond to distances on the Archives rifle is the basis for determining whether the rifle photographed has the same proportions as the Archives rifle.

(209) As one looks at a photograph, depending on the degree of tilt, it may or may not be obvious whether the muzzle was tilted away from the camera or toward it. There is a mathematical test that can be applied to the measurements on the photograph to determine which way the muzzle was titled, assuming that the photographed rifle does, in fact, have the same proportions as the Archives rifle. The sight-to-muzzle length divided by the sight-to-butt length of the rifle in the Archives is 465.8/553.0. If the corresponding ratio for lengths measured on the photograph is less than this number, the muzzle was foreshortened because it was tilted away from the camera. If the ratio is greater, the muzzle was tilted toward the camera.

(210) For the sake of convention, each measurement of sight-to-muzzle and sight-to-butt length was assigned a positive or negative number, depending upon which way these respective parts were tilted in relation to the camera. The respective part tilted away from the camera was assigned the positive number and the respective part tilted toward the camera was assigned the negative number. See table 3.

(211) If the tilt angle t, the axial image distance v, the length X_1, on the Archives rifle, and x_1 on the photographic negative are known, it is possible to compute the distance u from the center of the object (the rear sight of the rifle photographed) to the camera lens:

$$u = \frac{X_1}{x_1} (v \cos t = x_1 \sin t)$$

(212) Given these five relationships, the following sequence of operations were used to compare a photographed rifle with the rifle in the Archives. The lengths of many parts of the rifle in the Archives were measured. The points to which measurements were made are named in table 2 and the measured distances are given in the first column of table 5. All lengths were measured along lines parallel to the bore. The corresponding lengths were measured on a photograph. Twelve photographs, representative of all the photographs examined (see table 1) were selected for measurement. These measurements are given in table 3.

(213) When the negatives were available, as was the case for photographs by William Allen, Dallas Police (one instance), and McCamy, the enlarged magnification was computed from material deleted, see text measurement of the distance between frame borders depicted on the enlargement and measurement of the actual distance between frame borders by the Geological Survey. In all other cases, magnification was estimated.*

(214) The focal lengths of camera lenses were known for the backyard photograph (calibrated by the Geological Survey; see Addendum B), McCamy's photograph (calibrated by McCamy), and the Dallas

*Magnification, focal length, and object distance were estimated by knowing or assuming the size camera used and by visual inspection of the given print. These first estimates provided a starting point for the computations. A series of computations refined the estimates until a consistent set of values was found. If the assumed camera size were erroneous, the assumed magnification would be wrong and the axial image distance computed would be off by the same factor. These effects would cancel, so the erroneous estimates would not affect the determination of the proportions of the rifle. It would be immaterial whether we were measuring a 2x enlargement of a negative 4 inches wide or an 8x enlargement of a negative 1 inch wide.

Police laboratory photographs (nominal focal length supplied by Dallas Police).(*76*) Other focal lengths were estimated by taking into account common practice at the time the photographs were made. The object distance u was measured for the McCamy photograph. In all other cases, it was estimated.

Sequence of Computations

(215) 1. Based on known or estimated object distance and focal length, the first estimate of axial image distance v was computed by the second equation in paragraph 207.

2. Based on known or estimated magnification, negative image lengths x were computed from measured corresponding lengths x' on enlargements by the last equation in paragraph 205.

3. A first estimate of tilt angle t was computed by the equation in paragraph 208.

4. A second estimate of object distance u was computed by the equation in paragraph 211, based on the first estimates of v and t.

5. A second estimate of axial image distance v was computed by the second equation in paragraph 207, based on the second estimate of u.

6. A second estimate of t was computed based on the second estimate of v.

7. A third estimate of u was computed based on the second estimates of v and t.

8. The computations were done repeatedly, each time using the last computed estimates of t, u, and v. From one computation to the next, the successive approximations changed less each time until, finally, no appreciable change was found from one computation to the next. This determined the set of values of u, v, and t that scaled the two main parts of the photographed rifle to the Archives rifle and took into account the tilt angle.

(216) Given u, v, and t, the first equation in paragraph 207 was used to compute the lengths X of various parts of the rifle as deduced from the lengths x of corresponding parts on the negative image. The computed lengths X of the parts of the rifle could then be compared directly to measured lengths of parts of the Archives rifle. If the lengths of various parts of a photographed rifle were proportional to corresponding parts on the Archives rifle, the lengths computed by this procedure would match the lengths measured on the Archives rifle.

(217) In performing these calculations, the same scale for all measurements was used. It was uncalibrated except that the centimeter divisions were checked for consistency. The rifle was measured with an uncalibrated steel metric tape.

(218) The results of these calculations are set forth in tables 4 and 5. In each instance, the relative lengths of the corresponding measured parts were found to be proportional, and the resulting computed lengths matched very closely. In performing the computations, it is important to bear in mind the sign of X and x. They are negative when referring to the part of the rifle tilted toward the camera. In particular, the second term in the denominator of the first equation in paragraph 207 is a negative quantity toward one end of the rifle and positive toward the other.

(219) The two endpoints of the rifle and the rear sight are anchor points for the analysis, so they should not be regarded as measured

values. Each of 10 other points was measured by the technique given for all of the 12 photographs on which the points were visible. The mean value was computed for each point. The average deviation of the values from the mean of each point was computed. The deviation of the mean value from the value for the Archives rifle was computed. All of the data are given in table 5.

(220) The computed distances were within 3 or 4 millimeters of the corresponding distances on the rifle in the Archives; this reflects an approximate error of 1 percent between the actual lengths on the rifle and the lengths computed from the photographs. A comparison of tables 3 and 5 shows that the computed distances involved multiplication factors ranging from 4 to 17 times the distances measured on the photographs. Thus, the errors of measurement were magnified by these amounts. Since measurement errors of a small fraction of a millimeter should be expected, such errors would reasonably account for the deviations from the Archives rifle.

(221) The agreement of the data clearly contradicts the claims of gross discrepancies in proportions of the rifles photographed and offers strong evidence that the rifle or rifles photographed had the same proportions, within reasonably expected experimental error. The only way that there could have been a rifle depicted in these photographs with proportions substantially different from those of the Archives rifle, and yet matched when mathematically oriented at the computed angle t and distance u, would have been if someone deliberately manufactured a special rifle with all dimensions distorted in precisely the right way to appear to match when viewed at some angle other than t. In that case, it would have been necessary to align this specially contrived rifle and the camera very meticulously at the time the pictures were made. It is highly unlikely that anyone could have perpetrated such a ruse without detection in front of the Book Depository or in the halls of the Dallas Police Station a few hours after the assassination of the President. Aside from this possibility, the method used would show close agreement only if the photographed rifle had the same proportions as the Archives rifle, within reasonably expected experimental error, and, of course, this is not what has been claimed by Warren Commission critics. (*77*)

(222) In making the measurements, it is necessary to give some attention to perspective. The simple equations refer to a line, that is, the centerline of the bore of the rifle. They also apply to nearby lines parallel to that line. Nevertheless, if the rifle is tilted and twisted about the centerline, as shown in figure 7, the twist throws the image of the butt to the right. In making the measurements, this must be judged and the line drawn from the butt to the centerline must be angled in keeping with the perspective; this means that the solid line in figure 7, rather than the dotted line which is perpendicular to the centerline, must be used. This comes quite naturally if we let our visual sense guide us. (Notice that even in the crude drawing of fig. 7, the dotted line does not appear to be perpendicular to the centerline. This is an optical illusion. If the perspective is sensed, the solid line appears to be more nearly perpendicular.) High precision requires this technique to be used for all measurements when the endpoints are not the same distance and direction from the centerline. The case illustrated in figure 7 is an exaggeration of photograph 11 (see table 1), where the form of the butt provides a clear indication of the perspective angle.

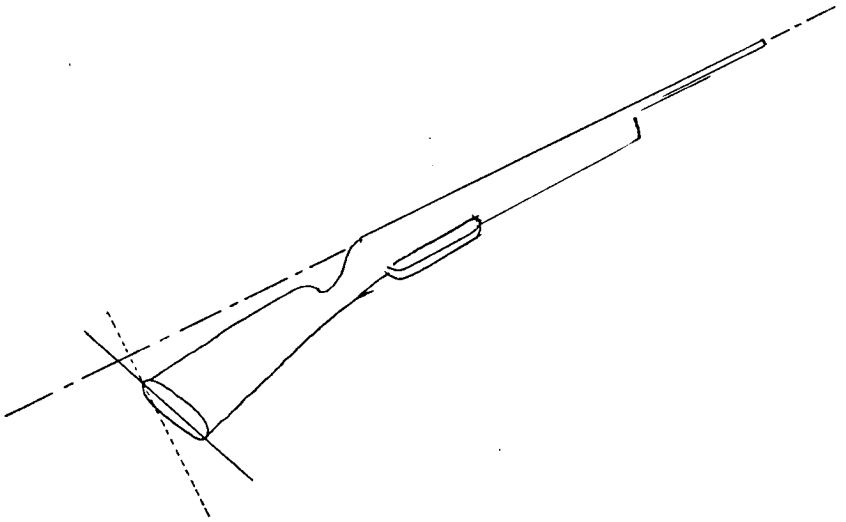

FIGURE III–7.—Taking perspective into account in measuring distances of points off the centerline of the rifle bore, such as the butt, comb, trigger, and trigger guard.

(223) The backyard photograph presented some special problems. The hand obscures the exact location of the rear sight. (See fig. III–3a.) A nearby groove on the outside of the chamber was visible and the rear sight was located relative to this groove. The rear sight was not centered in the photograph but the rear end of the bolt was. The analysis was done relative to the rear end of the bolt and the lengths were then translated to be zero at the rear sight for comparison with the Archives rifle.

(224) Vertical lines near the edge of the picture bow out very appreciably at top and bottom. This is known as "distortion." The distortion of the lens said to have been used to take this picture was measured by the Geological Survey. The image lies along the diagonals designated 90° and 270° by the Geological Survey. The reported distortion along this axis was plotted and appropriate distortion corrections were interpolated on this plot. The distortion correction was 0.2 mm for points 6 and 7. It was negligible for all other points. Since the distortion was positive, these amounts were subtracted from distances computed for the original negative image from measurements on the enlargement. No distortion corrections were made for other photographs or for the enlarging lenses because no distortion information about the cameras that were used to take these photographs was available. Nevertheless, since the photographs other than the backyard photograph were professionally made, the lenses probably had very small distortion.

(225) In addition to the photographs of this rifle, a photograph made by the Metropolitan Police Department of Washington, D.C., of a different specimen of the same kind of rifle was examined and analyzed for the purpose of determining whether the relative properties of Mannlicher-Carcano rifles are necessarily identical. See figure III–8,

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No. 4 and No. 5. (JFK exhibit F–206) The data are shown in the tables for picture No. 21.

(226) The metal parts coincide very well except for the rear of the bolt. In this photograph only, the bolt appears to be in the firing position. In all other photographs, it is in the cocked position. This being the case, such a discrepancy should be expected. The only point of comparison of the wooden stocks is the comb, and the computed distance to the comb on this extra specimen is outside the range of computed values of this distance on all the photographs of the Archives specimen. This suggests that there were small differences in manufacturing the wooden parts. This is borne out by the further observation that two angles on the butts are measurably different on photographs 20 and 21 by the Metropolitan Police Department. The rear line of the butt is at an angle to the perpendicular to the bore. On the Archives specimen it is 6.5°; on the extra specimen it is 10°. The bottom straight line of the stock is at an angle to the bore. On the Archives specimen it is 18°; on the extra specimen it is 19°.

(227) There are many sources of error not accounted for in this analysis. The distortion of camera and enlarging lenses has been mentioned. In addition, film changes size and shape during processing and subsequent to processing as the temperature and humidity change. The same may be said of paper prints. Finally, there are natural limits to the precision of measurements involving decisions as to the exact endpoints to set on, interpolation, parallax, inaccuracy of the scale used, and alinement of the scale with the center line.

Ultimately, however, when the computed distances were scaled to the photographs, the deviations from the Archives rifle amounted in most cases to a small fraction of a millimeter. It would be reasonable to expect that the effect of the potential errors cited would be of that magnitude.

Identifying Marks

(228) Twenty-one photographs were taken of the rifle in the National Archives in Washington, D.C., on April 18, 1978. These photographs, figures 4a–u, are numbered from A–1 to A–21 in the upper right-hand corner. See table 6. Identifying marks are lettered on the photographs. Table 7 indicates the earlier photographs from the preceding section on which the same marks may be observed. There are 56 citations of 22 different identifying marks on the early photographs, and 13 on the photograph of the alleged assassination weapon that was recently made by the Metropolitan Police Department of Washington, D.C. The list of identifying marks includes the more prominent markings found on the photographs from the preceding section but is not exhaustive. In many cases, smaller or less prominent nearby marks are seen as well.

(229) Identifying mark L refers to the pattern of vertical lines apparently left in the horizontal groove by the woodworking operation used in manufacturing the stock. These may be regarded as several points of evidence. The mark "VE [trefoil] K" (identification mark U), the date "November 22, 1963," and "PMS" or "RMS" "November 1963", have been scratched into the butt, as shown on pictures A–6, A–10, A–11, A–16, and A–21, possibly by law enforcement officials. Only the trefoil of mark U appears on the Fort Worth Star Telegram

photograph No. 13 in table 1, but the initials in identification mark U are seen on photograph No. 15 taken by the Dallas Police Department later that day. The lighting revealing the trefoil should have revealed the initials immediately to either side of it in picture 13 if they were, in fact, there at the time that the picture was taken. None of the cited identifying marks were observed on photograph No. 21 of another specimen of the same kind of rifle.

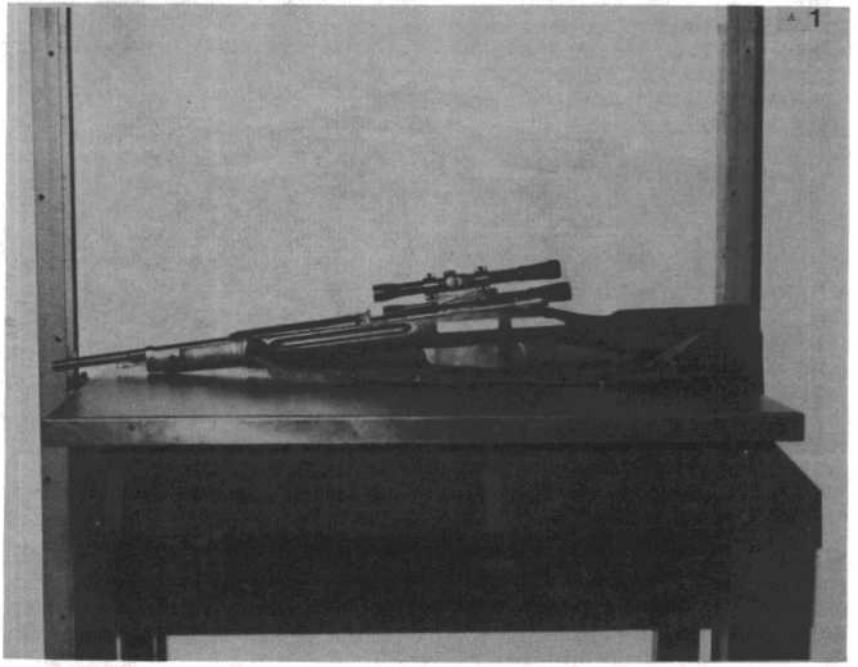


FIGURE III–4a.—McCamy's Archives rifle photograph.

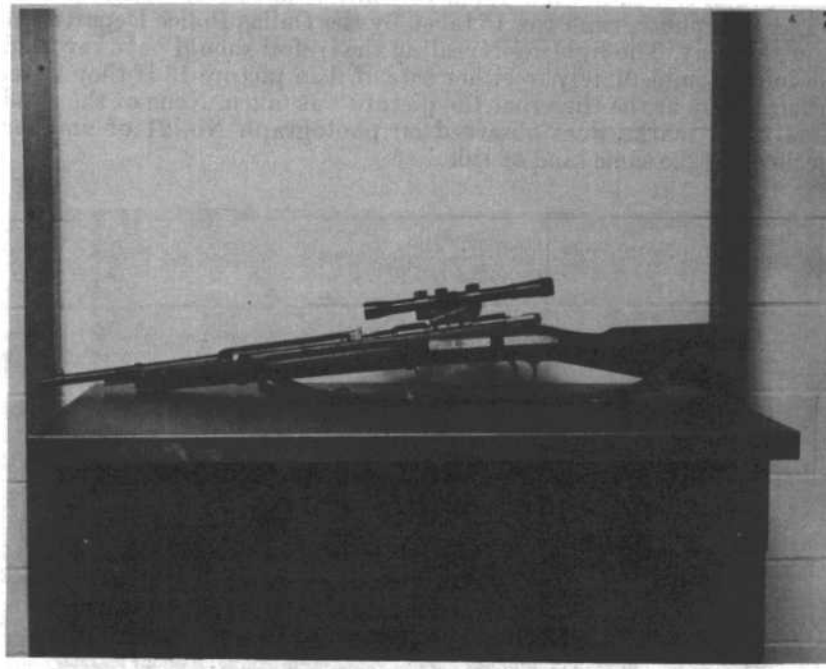


FIGURE III–4b.—McCamy's Archives rifle photograph.

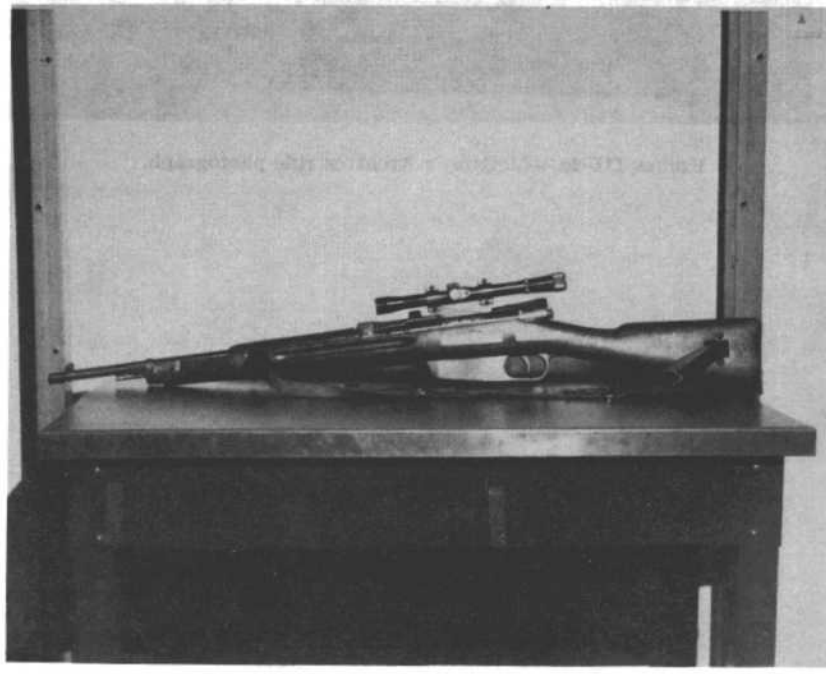


FIGURE III–4c.—McCamy's Archives rifle photograph.

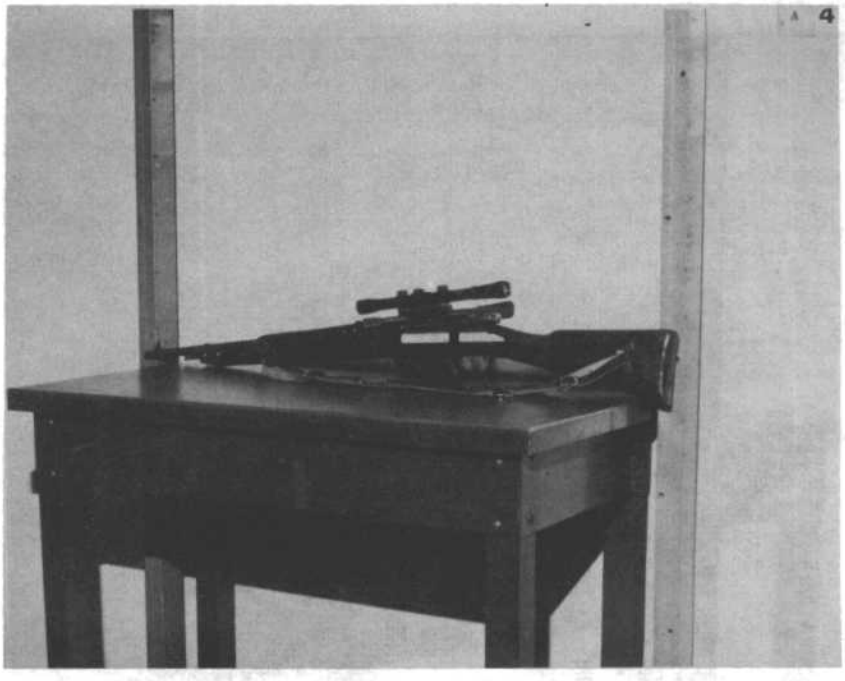


FIGURE III–4d.—McCamy's Archives rifle photograph.

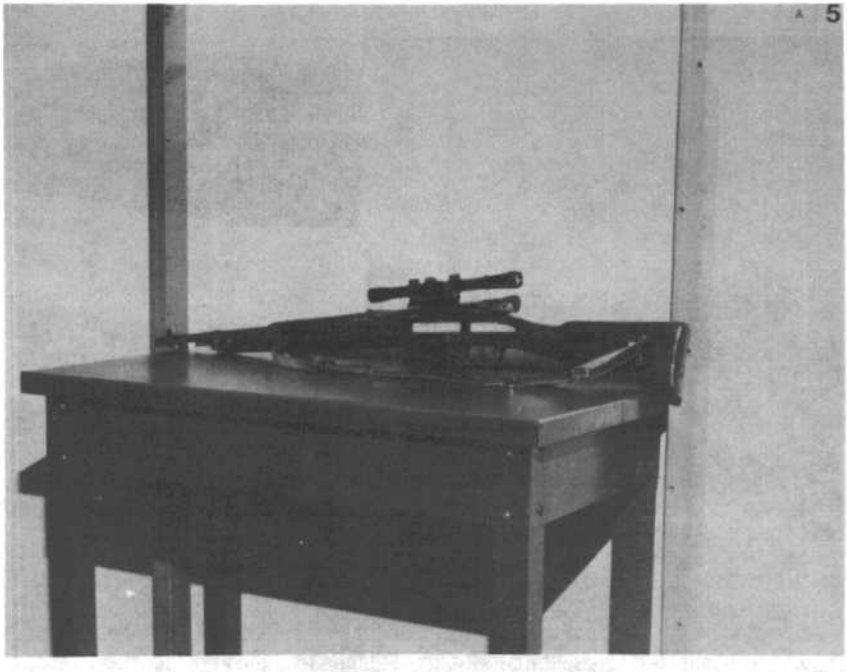


FIGURE III–4e.—McCamy's Archives rifle photograph.

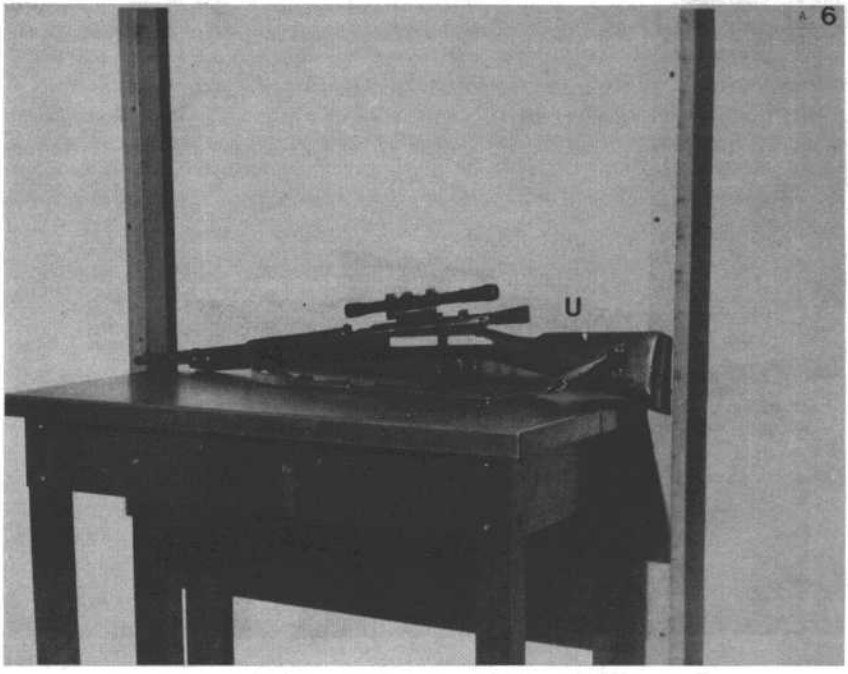


FIGURE III–4f.—McCamy's Archives rifle photograph.

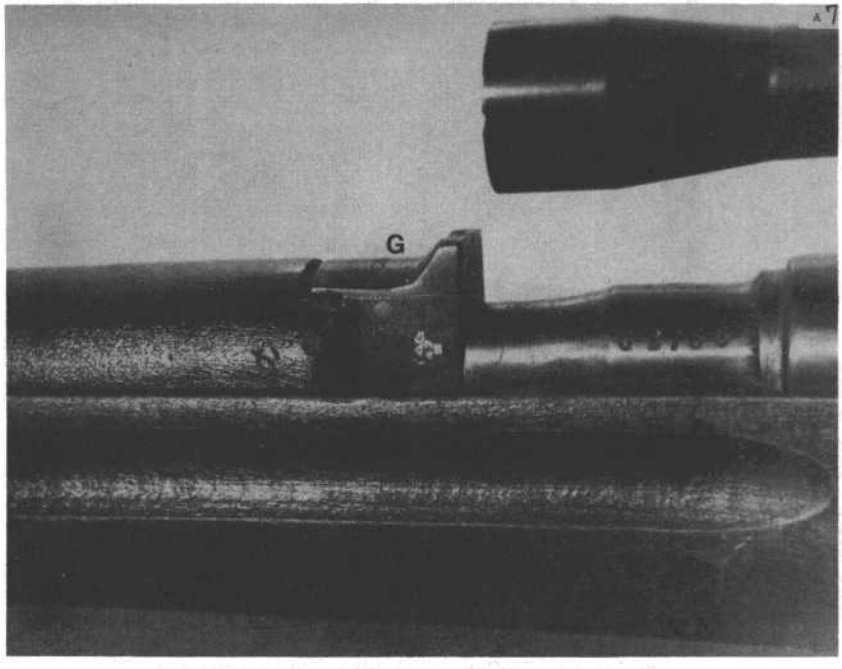


FIGURE III–4g.—McCamy's Archives rifle photograph.

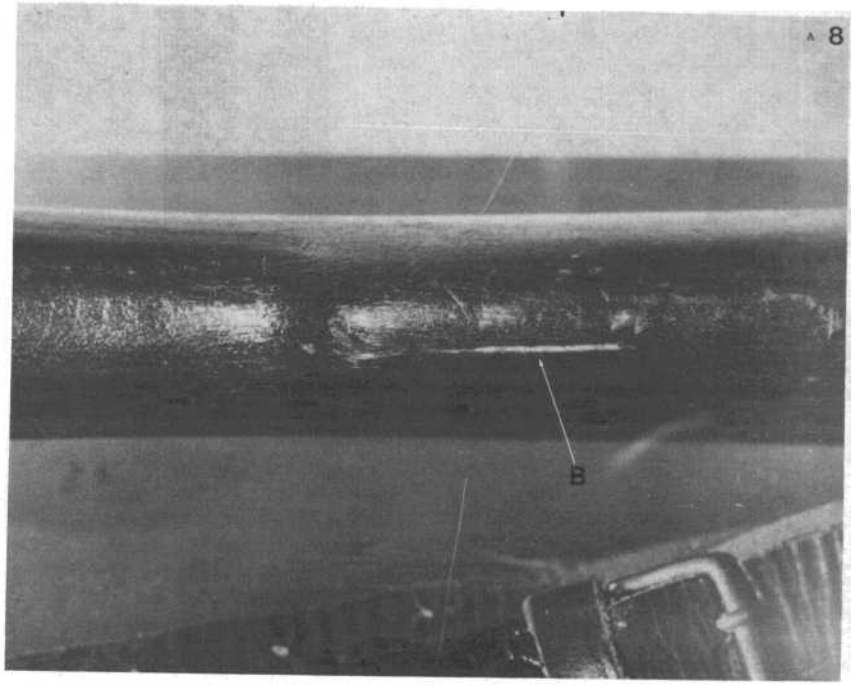


FIGURE III–4h.—McCamy's Archives rifle photograph.

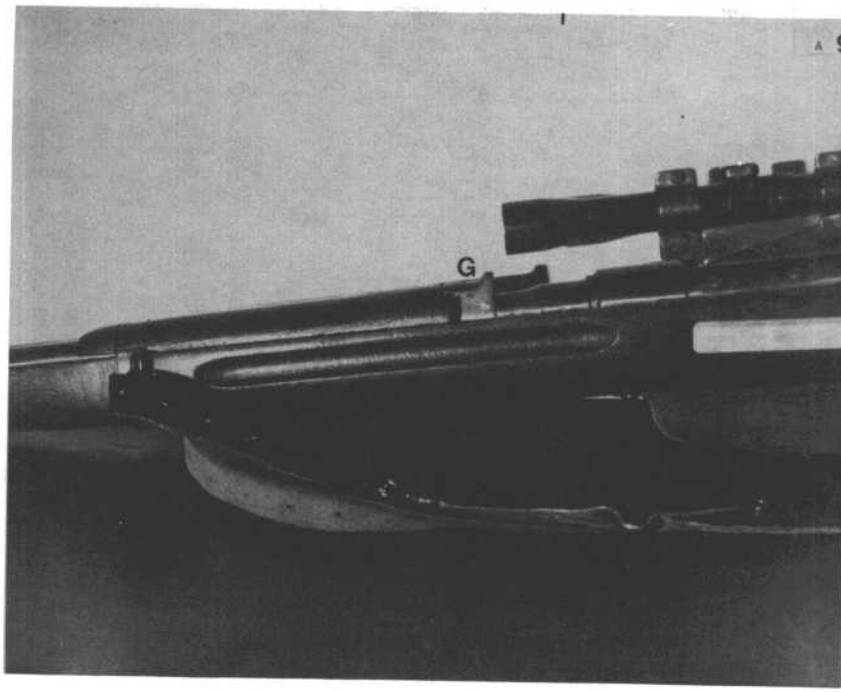


FIGURE III–4i.—McCamy's Archives rifle photograph.

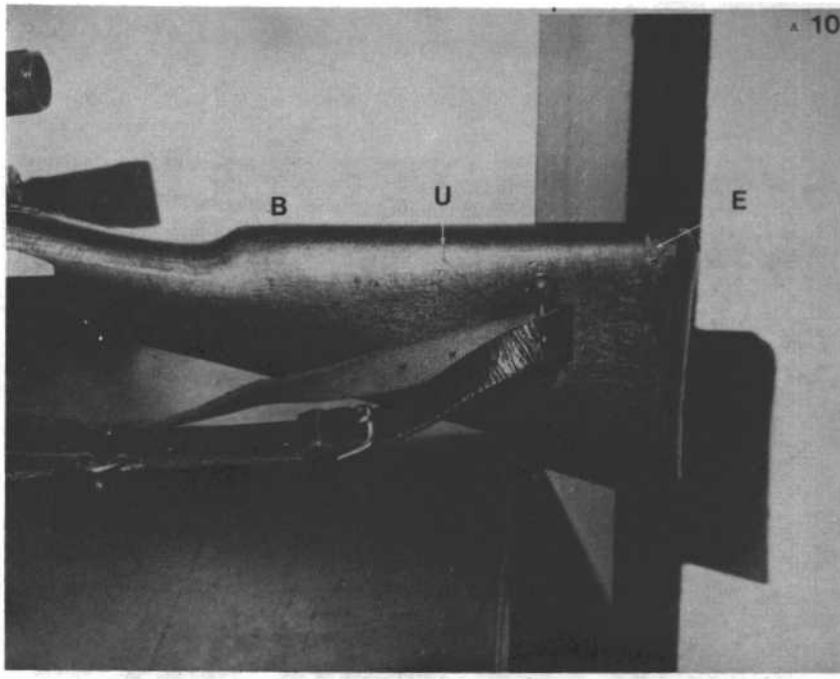


FIGURE III–4j.—McCamy's Archives rifle photograph.

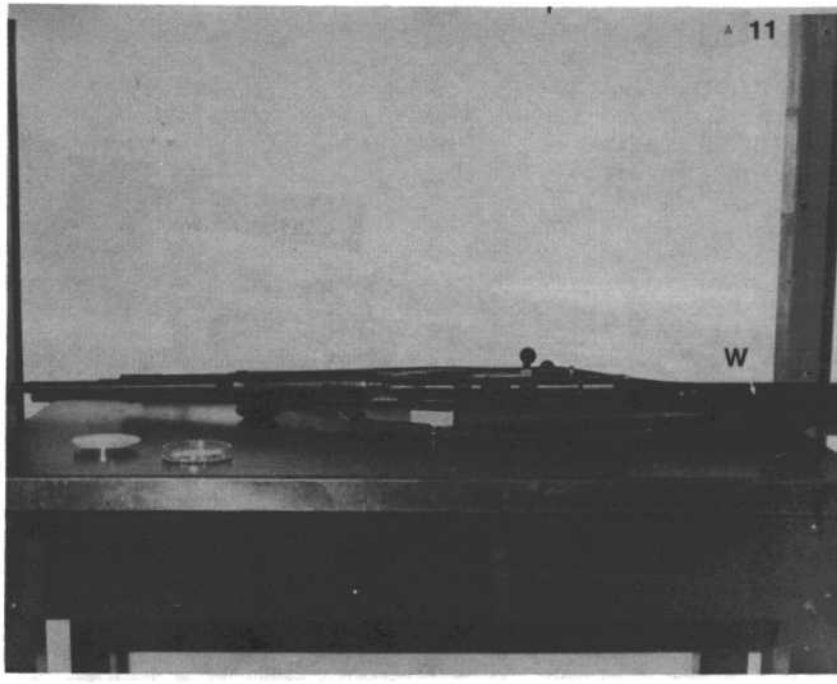


FIGURE III–4k.—McCamy's Archives rifle photograph.

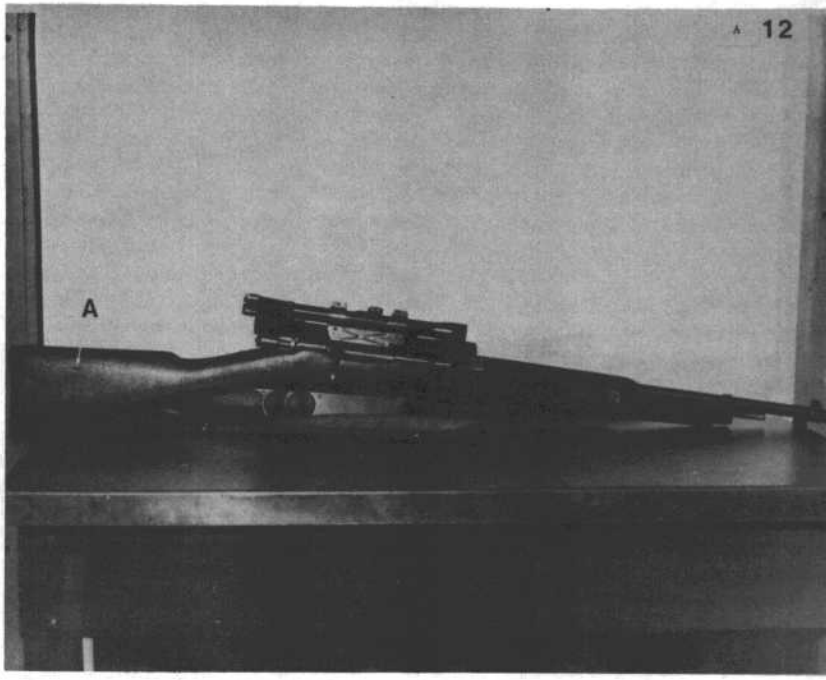


FIGURE III–4l.—McCamy's Archives rifle photograph.

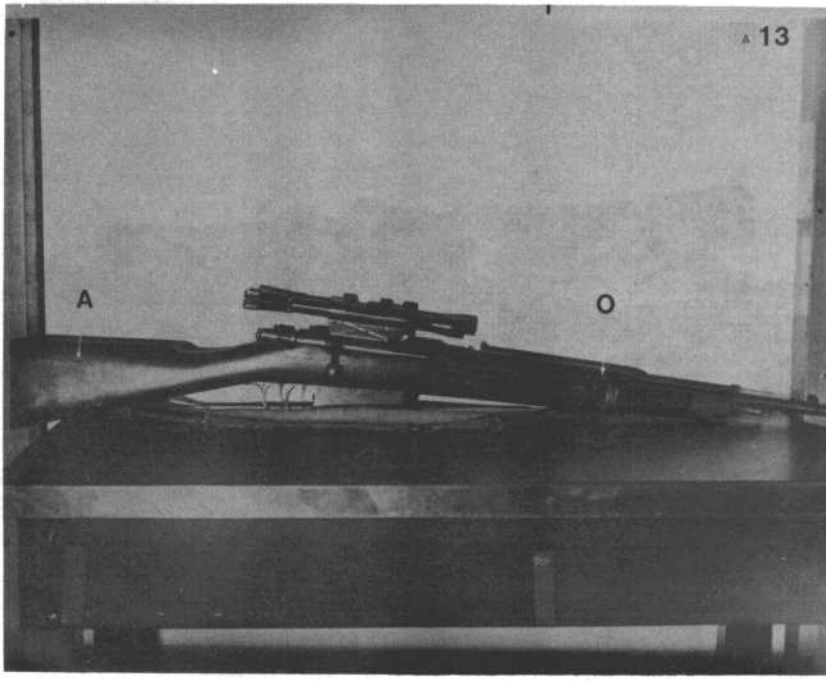


FIGURE III–4m.—McCamy's Archives rifle photograph.

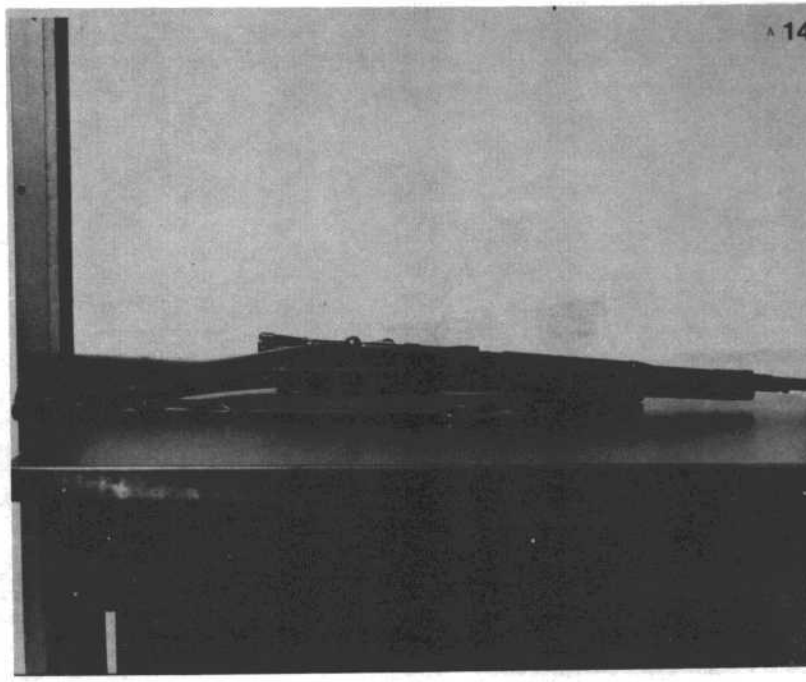


FIGURE III–4n.—McCamy's Archives rifle photograph.

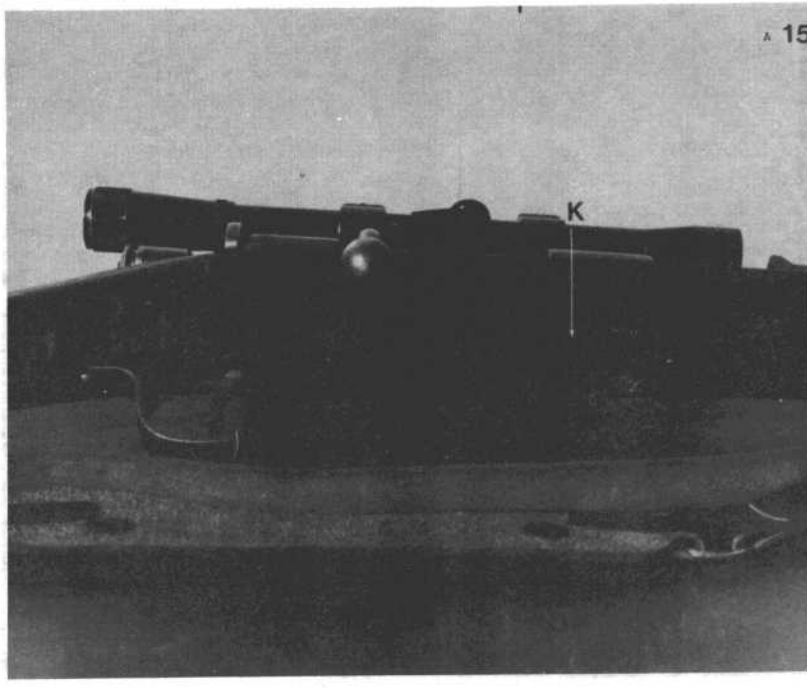


FIGURE III-4o.—McCamy's Archives rifle photograph.

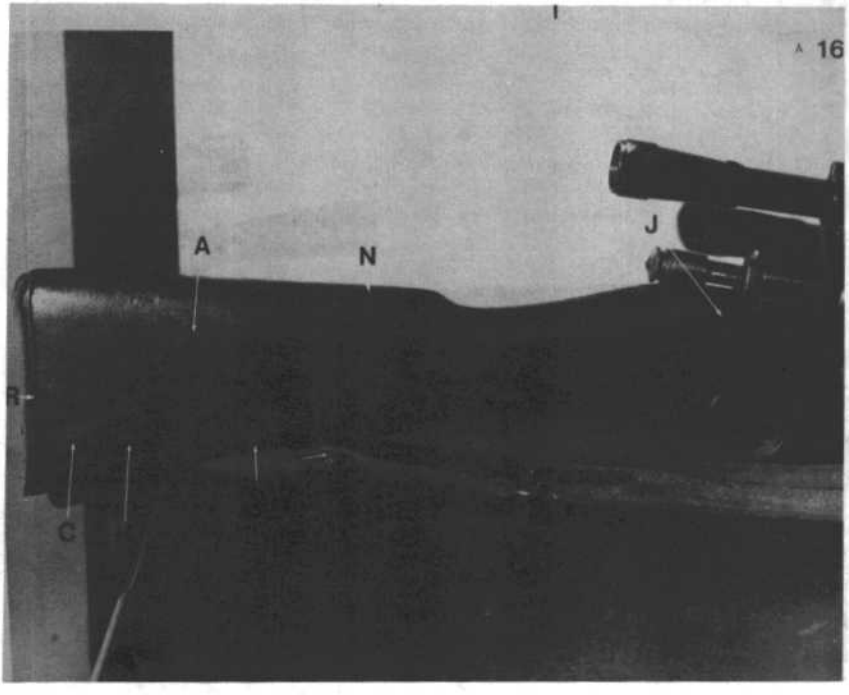


FIGURE III–4p.—McCamy's Archives rifle photograph.

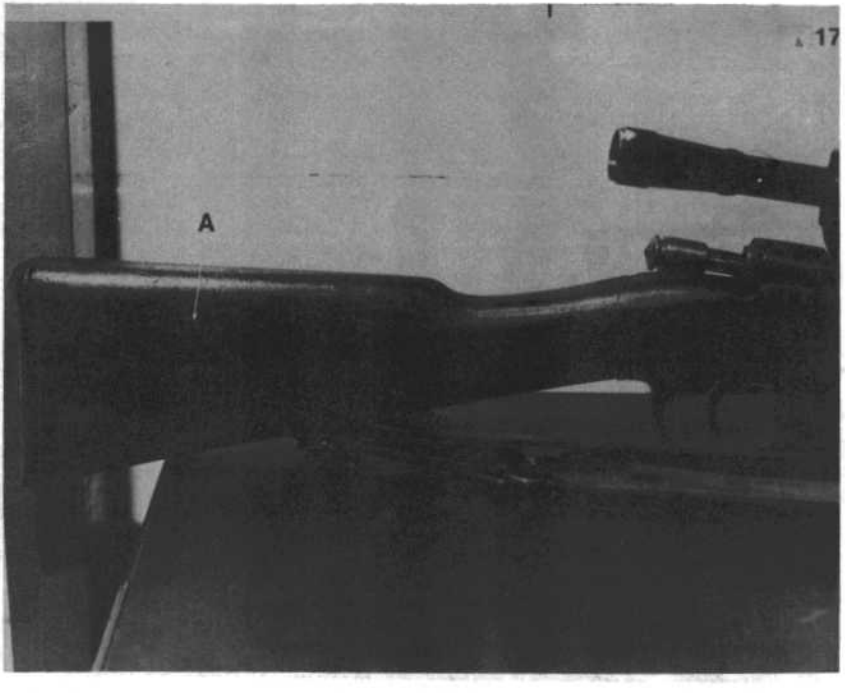


FIGURE III–4q.—McCamy's Archives rifle photograph.

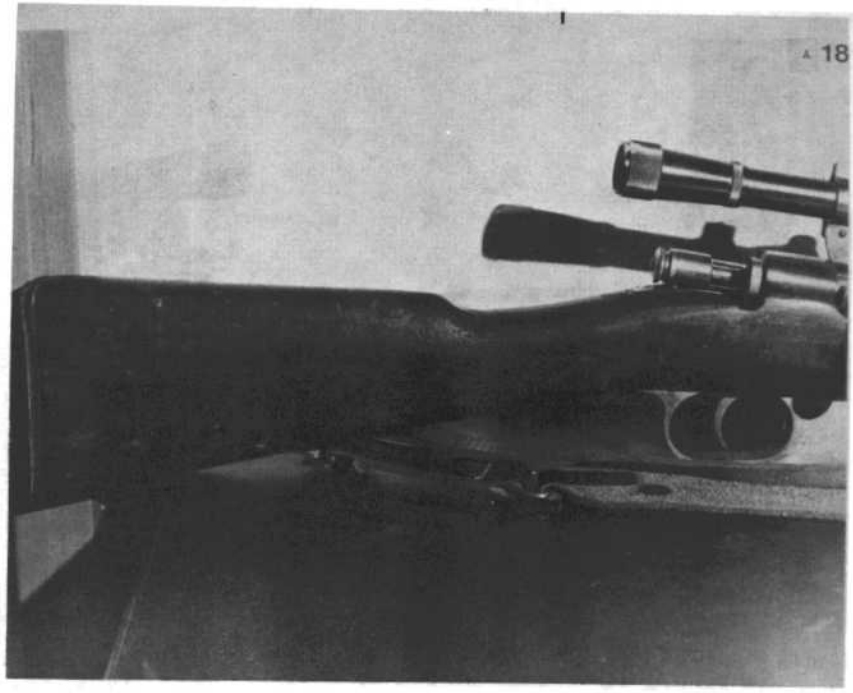


FIGURE III–4r.—McCamy's Archives rifle photograph.

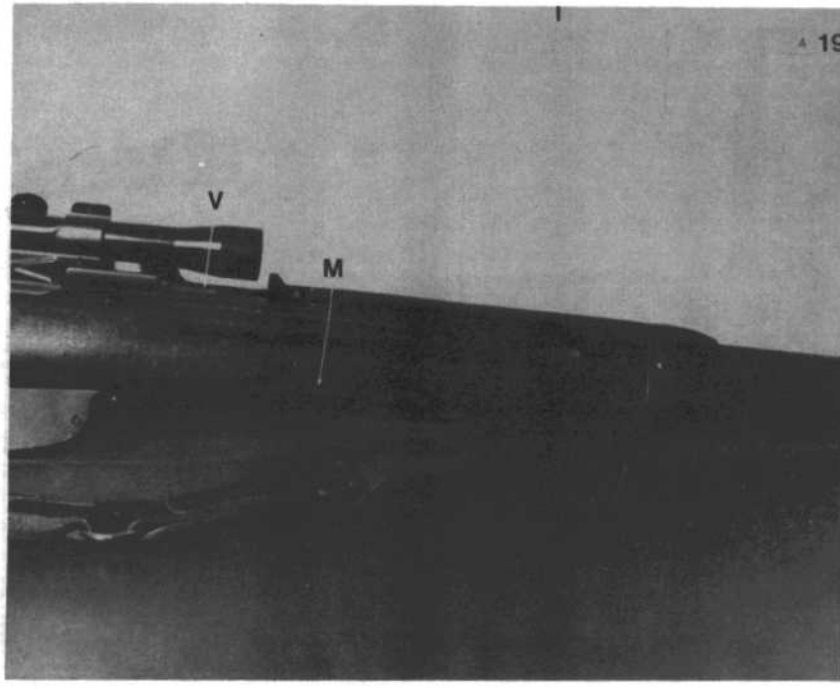


FIGURE III–4s.—McCamy's Archives rifle photograph.

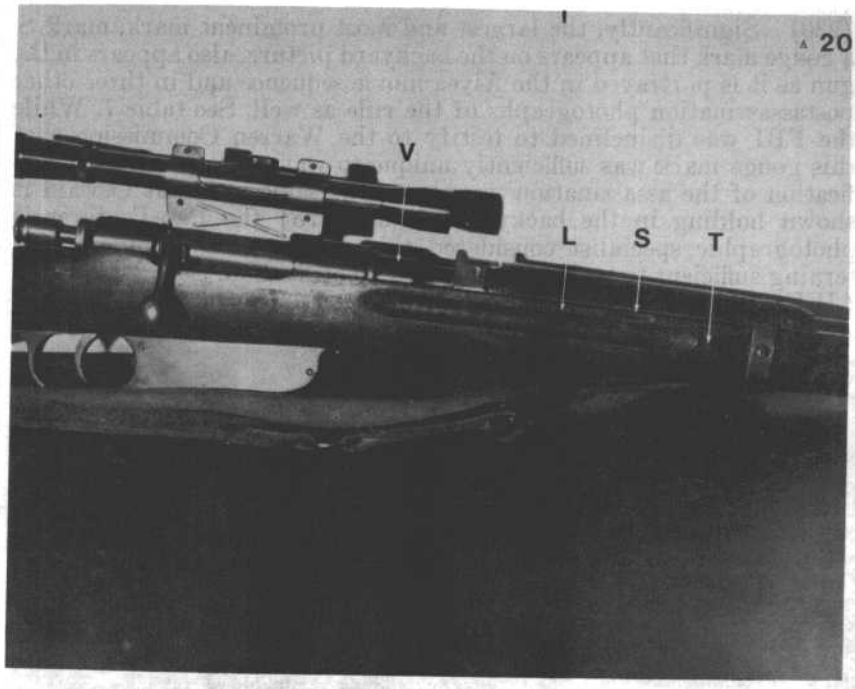


FIGURE III–4t.—McCamy's Archives rifle photograph.

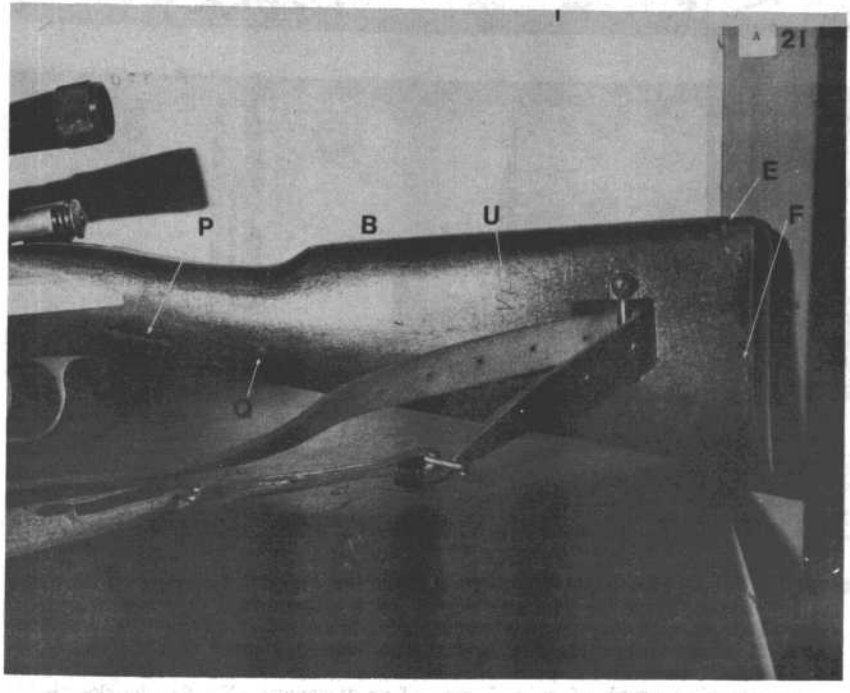


FIGURE III–4u.—McCamy's Archives rifle photograph.

(230) Significantly, the largest and most prominent mark, mark S, a gouge mark that appears on the backyard picture, also appears in the gun as it is portrayed in the Alyea movie sequence and in three other postassassination photographs of the rifle as well. See table 7. While the FBI was disinclined to testify to the Warren Commission that this gouge mark was sufficiently unique to warrant a positive identification of the assassination weapon as the same gun that Oswald is shown holding in the backyard picture, (*78*) the Panel's forensic photographic specialist considered this mark to be a random patterning sufficient to warrant a positive identification. See figure III–8 (JFK exhibit F–206 and addendum C).

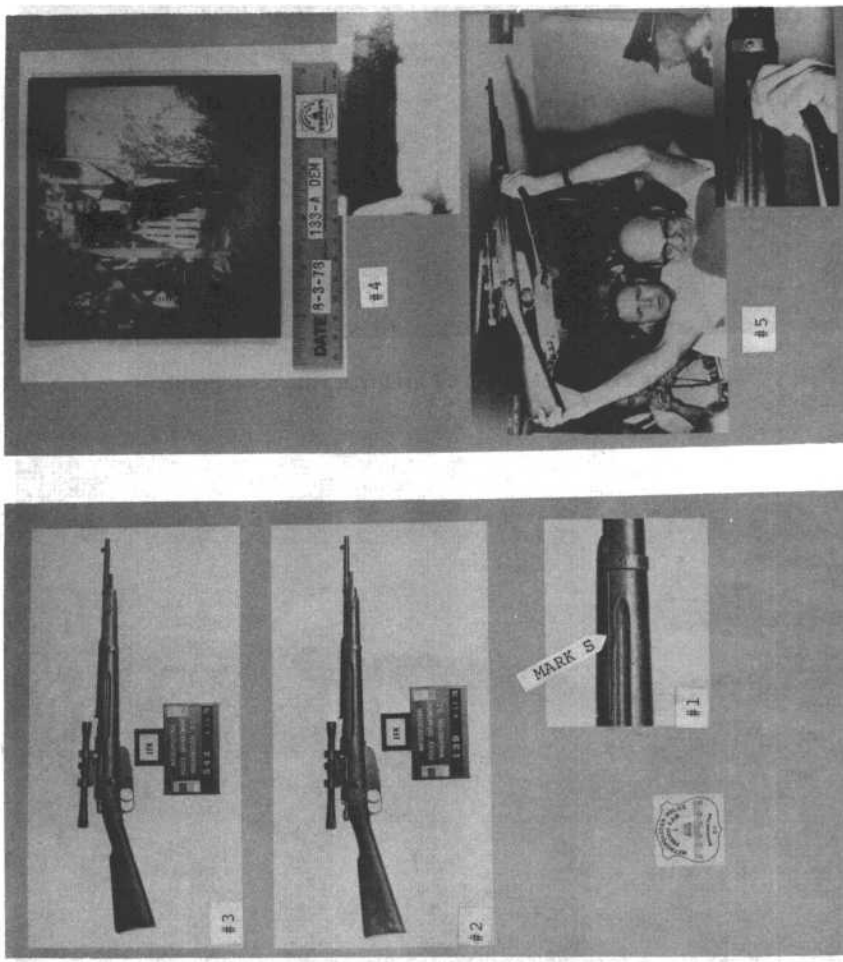


FIGURE III–8.—(JFK exhibit F–206) Identifying mark S (gouge on forestock) considered to be a "random pattern." (See addendum D.) Clockwise from left: Enlargement of Archives rifle shows mark S (No. 1); Archives rifle (No. 2) and another Mannlicher-Carcano (No. 3)—mark S only visible on No. 2; de Mohrenschildt print of CE 133–A (No. 4) and Fort Worth Star Telegram photograph of rifle shortly after discovery (No. 5); marks visible on enlargements of both photographs.

(231) Finally, the most common misconception regarding photographic evidence is the idea that all photographs of the same object must look alike. The appearance of the image depends on level and directions of illumination, point of view, kind of film or plate, exposure, focus, and a host of other factors. Pictures A–1, A–2, and A–3 in this series were made with the camera and rifle in the same position; only the lighting was changed. Note the difference in appearance, particularly in the wooden parts. Picture A–1 is directionally lighted from the upper left, picture A–3 from the upper right, and picture A–2 was diffusely lighted from overhead. The same kinds of differences are seen in A–5 and A–6, in A–7 and A–9, in A–6, A–7, and A–8 and in A–10 and A–21. Note that mark A appears light on a dark background on picture A–1, but dark on a light background in picture A–2, simply because the lighting is different. One must be careful not to conclude that marks were not on the rifle at the time a picture was made simply because the marks are not seen in the picture.

Conclusion

(232) 1. A comparison of the relative lengths of parts of the alleged assassination rifle that is in the National Archives with corresponding parts of what purports to be that rifle as shown in various photographs taken in 1963 indicates that the dimensions of the rifle(s) depicted are consistent.

(233) 2. A comparison of identifying marks that exist on the rifle as shown in photographs today with marks shown on the rifle in photographs taken in 1963 indicates both that the rifle in the Archives is the same weapon that Oswald is shown holding in the backyard picture, and the same weapon that was seized by Dallas Police and appears in various postassassination photographs.

TABLE 1.—PHOTOGRAPHS ANALYZED

[In chronological order of original image]

Exhibit No. and photo No.	Identification No.	Source	Description
III—3a:			
0 [1]	133–A	Dallas Police (Oswald)	Backyard photograph.
1	HSCA 003403	Dallas Police	Rifle where found.
III—3b:			
1a [1]	HSCA 007536	WFAA–TV, T. Alyea	Movie in book depository.
2	HSCA 003295	Dallas Times Herald, Allen 5–11	Rifle carried in street.
3	HSCA 003295	Dallas Times Herald, Allen 5–12	Do.
III—3c:			
3a [1]	HSCA 003295	McCamy's print of above	Do.
4	HSCA 003295	Dallas Times Herald, Allen 5–13	Do.
5	HSCA 003295	Dallas Times Herald, Allen 5–15	Do.
III—3d:			
5a [1]		McCamy's print of above	Do.
6	HSCA 003294	United Press International	(Enlargement of No. 5).
7	HSCA 003295	Dallas Times Herald, Allen 5–16	Rifle carried in street.
8	HSCA 003294	United Press International	(Enlargement of No. 7).
9	HSCA 003295	Dallas Times Herald, Allen 5–17	Rifle carried in street.
10	HSCA 003295	Dallas Times Herald, Allen 5–18	Do.
III—3e: 11 [1]	HSCA 003356	Fort Worth Star Telegram	Rifle in police station.
III—3f: 12 [1]	HSCA 003294	United Press International No. 1402594	Do.
III—3g: 13 [1]	HSCA 003356	Fort Worth Star Telegram	Do.
III—3h: 14 [1]	HSCA 003403	Dallas Police Department	Laboratory photograph.
III—3i: 15 [1]	HSCA 003403	do	Do.
III—3j:			
16	HSCA 003403	do	Do.
17		do	(Negative) laboratory photograph.
III—3k:			
18 [1]		Federal Bureau of Investigation	Laboratory photograph.
19		McCamy	Rifle in National Archives.
III—3l:			
20 [1]	MPD 139 4–15–78	Metropolitan Police Dept., Wash., DC	Laboratory photograph.
21	MPD 542 4–15–78	do	Laboratory photo of a different specimen of this kind.

[1] See table 7, photographs depicting ID marks.

TABLE 2.—*Selected points on the rifle and rifle images*

(Measurements were made from the rear sight to each selected point)

1. Muzzle.
2. Front of band supporting front sight.
3. Rear of band supporting front sight.
4. Front end of bayonet mount.
5. Front end of bayonet mount ring.
6. Front end of ring over the stock clamp.
7. Front end of stock band.
8. Rear flat of rear sight.
9. Front of trigger guard.
10. Front of trigger.
11. Rear of bolt (bolt closed).
12. Comb.
13. Butt.

TABLE 3.—LENGTHS MEASURED ON ENLARGEMENTS (mm)

	Photograph No.												
	0[1]	3a	5a	11	12	14	15	16	17[2]	18	19	20	21
Point:													
1	−37.7	−115.3	103.4	54.2	84.0	−64.3	53.2	50.4	−28.1	94.1	−101.8	−107.6	105.8
2	−35.9	−109.2	98.8	51.8	80.0	−60.7	51.1	48.1	−26.6	89.8	−96.7	−102.2	100.8
3	−35.0	−106.5	96.1	50.2	78.0	−58.7	49.2	47.0	−25.7	86.7	−94.3	−99.6	98.0
4	−30.0		84.5	44.6	67.8	−50.4	43.7	40.8	−22.4	76.3	−81.6	−86.2	84.6
5	−28.2	−86.5	80.2	42.7	64.8	−47.3	41.4		−21.2	72.8	−77.5	−82.0	80.6
6	−26.6	−80.0	74.7	39.5	60.5	−43.8	38.4	37.0	−19.7	67.3	−72.0	−76.3	75.0
7	−15.0	−44.7	43.0	23.8	34.6	−23.8	22.2	21.2	−11.0	39.2	−40.9	−43.3	42.5
8	0	0	0	0	0	0	0	0	0	0	0	0	0
9			−16.0	−9.0	−12.9	8.0	−8.6	−8.3	3.7	−14.3	14.6	15.3	−15.5
10				−30.0	−39.7	23.7	−26.5	−26.0	12.0	−46.6	46.0	48.6	−48.4
11	20.2		−63.0	−36.3	−49.5	29.8	−33.8	−33.0	15.0		56.4	60.0	−56.4
12		76.5	−87.0	−53.0	−68.2	39.7	−46.8	−45.8	20.0	−80.1	77.6	82.3	−81.1
13	42.2	115.7	−138.0	−86.3	−107.0	58.6	−75.4	−73.0	30.6	−126.8	119.0	127.3	−126.4

[1] For an analysis of photograph 1a, taken by T. Alyea, which shows the rifle at the time that it was discovered by Dallas police officials, see addendum C.

[2] Measured on the negative.

TABLE 4.—DERIVED PHOTOGRAMMETRIC CONSTANTS

Photograph No.	Enlarger magnification M	Axial image distance v(mm)	Object distance u(mm)	Tilt angle t (degrees)
0[1]	3.343	78.8	3,419	7.515
3a	14.18	50.9	2,800	27.63
5a	16.0	50.8	3,237	21.5
11	6.94	35.76	1,660	28.06
12	7.0	35.94	1,346	5.339
14	2.1	135.6	2,004	31.47
15	2.1	135.0	2,136	21.73
16	2.1	134.9	2,177	24.97
17	1	134.5	2,277	11.17
18	1	396.0	1,807	12.90
19	9.222	51.65	2,194	1.963
20	3	107.69	1,401	.2874
21	3	107.59	1,417	.4880

[1] For the analysis of photograph 1a, taken by T. Alyea, which shows the rifle at the time that it was discovered by Dallas police officials, see addendum C.

TABLE 5.—COMPUTED LENGTHS OF PHOTOGRAPHED RIFLE COMPONENTS COMPARED TO MEASURED COMPONENTS ON ARCHIVES RIFLE

[Lengths in millimeters]

Archives rifle	Photograph No.												
	0[1]	3a	5a	11	12	14	15	16	17	18	19	20	21[2]
465.8	465.8	465.9	465.8	465.8	465.9	465.9	465.7	465.8	465.7	465.9	465.8	465.8	465.8
442.3	445.1	443.0	443.8	442.4	441.9	443.0	445.9	442.7	441.8	443.4	442.8	442.4	443.7
431.0	432.7	432.9	431.7	427.1	429.9	430.7	428.1	432.2	427.4	427.3	431.9	431.2	431.4
373.0	370.4	------	377.0	374.8	373.9	375.2	377.4	370.1	374.2	373.7	373.9	372.8	372.2
355.9	353.7	356.4	357.0	356.8	356.9	353.9	356.3	------	354.8	355.8	355.0	354.6	354.6
329.7	332.8	331.0	331.8	327.7	332.5	330.9	329.5	333.6	330.4	327.8	330.2	330.0	329.9
188.4	189.9	189.4	188.2	190.5	188.2	186.3	186.4	186.3	186.8	187.8	188.2	187.2	186.8
0	0	0	0	0	0	0	0	0	0	0	0	0	0
66.4	------	------	68.0	67.2	68.9	67.0	69.0	70.2	64.2	66.4	67.2	66.4	68.1
213.3	------	------	------	213.8	210.2	206.3	206.9	211.7	210.8	212.4	212.8	210.9	212.2
261.8	261.7	------	261.8	262.0	261.1	262.9	261.8	265.1	264.7	------	261.2	260.4	[3]247.2
359.0	------	354.3	357.5	361.3	357.3	358.0	356.4	360.9	355.6	358.4	359.9	356.8	[4]355.2
553.0	552.9	553.1	553.4	552.8	553.1	553.1	552.9	553.1	552.9	553.0	553.0	553.0	553.0

[1] For the analysis of photograph 1a, taken by T. Alyea, which shows the rifle at the time that it was discovered by Dallas police officials, see addendum C.

[2] A different specimen of the same kind of rifle.

[3] Bolt apparently in firing position.

[4] Small discrepancy between the butts of the two specimens.

TABLE 6.—*Photographs of rifle in the Archives exhibiting identifying marks*

Mark:	*(McCamy) National Archives photograph No. A—*
A	12, 13, 16, 17.
B	8, 10, 21.
C	16.
D	16.
E	10, 21.
F	21.
G	7, 9.
H	16.
J	16.
K	15.
L	20.
M	19.
N	16.
O	13.
P	21.
Q	21.
R	16.
S	20.
T	20.
U	6, 10, 21.
V	19, 20.
W	11.

FIGURE III–3a.—Table 7. Table 1 (photograph No. 0).

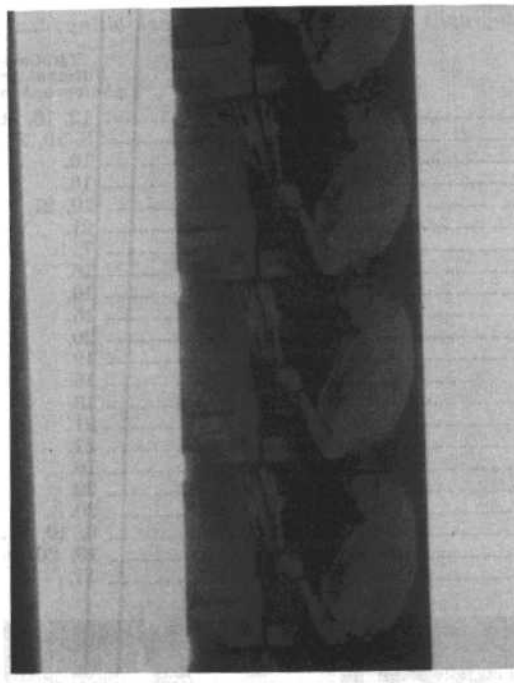


FIGURE III—3b.—Table 7. Table 1 (photograph No. 1a). (See attachment c).

FIGURE III–3c.—Table 7. Table 1 (photograph No. 3a).

FIGURE III–3d.—Table 7. Table 1 (photograph No. 5a).

FIGURE III–3e.—Table 7. Table 1 (photograph No. 11).

FIGURE III–3f.—Table 7. Table 1 (photograph No. 12).

FIGURE III–3g.—Table 7. Table 1 (photograph No. 13).

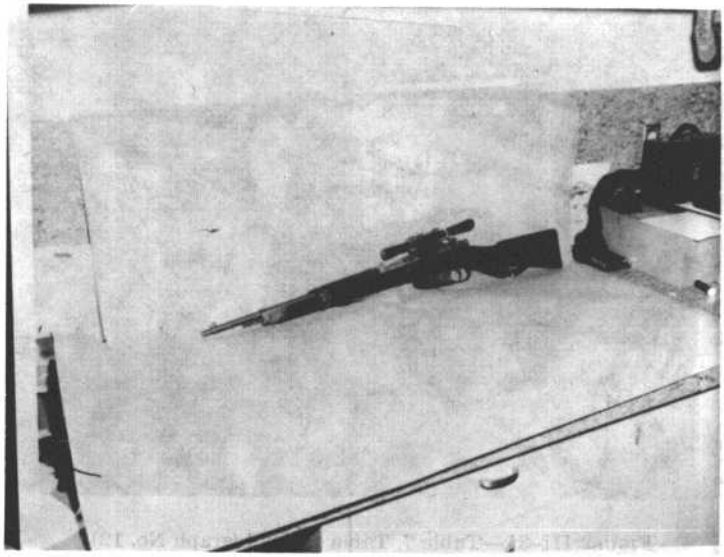


FIGURE III–3h.—Table 7. Table 1 (photograph No. 14).

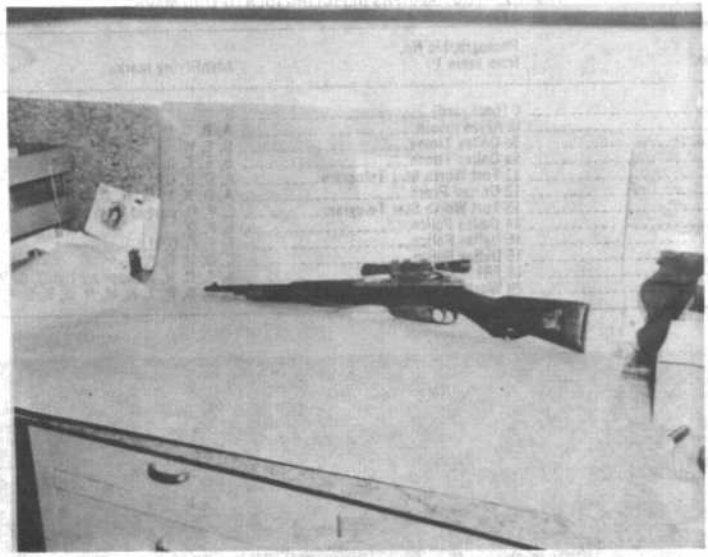


FIGURE III–3i.—Table 7. Table 1 (photograph No. 15).

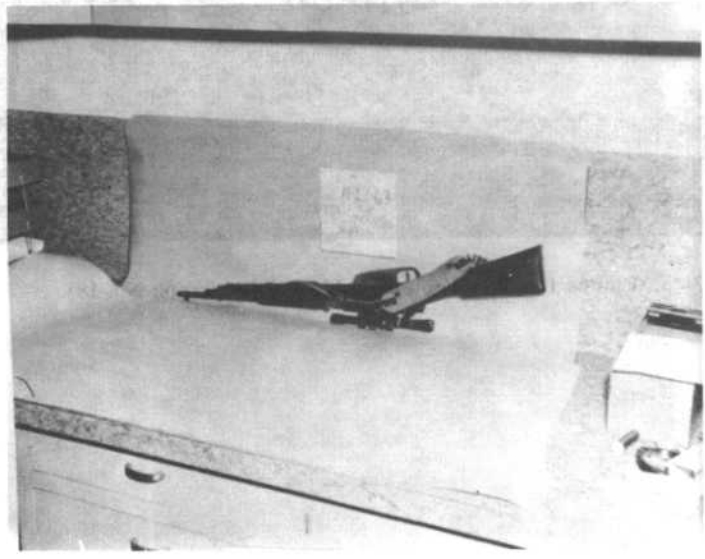


FIGURE III–3j.—Table 7. Table 1 (photograph No. 16).

TABLE 7.—PHOTOGRAPHS DEPICTING IDENTIFYING MARKS

Exhibit No.	Photographic No. from table 1	Identifying marks
III–3a	0 (backyard)	S.
III–3b	Ia Alyea movie	A, B, C, D, H, S.
III–3c	3a Dallas Times	B, E, W.
III–3d	5a Dallas Times	B, E, F, G, W.
III–3e	11 Fort Worth Star Telegram	A, C, D, G, J, K.
III–3f	12 United Press	A, D, K, L, M, N, O, S, T.
III–3g	13 Fort Worth Star Telegram	E, P, Q, part of U, W.
III–3h	14 Dallas Police	E, P, Q.
III–3i	15 Dallas Police	E, F, P, Q, U.
III–3j	16 Dallas Police	C, D, H, R, S, T.
III–3k	18 FBI	A, C, D, H, R (appears light), S, V.
III–3l	20 Washington Police	A, C, D, H, J, K, M, N, O, R, S, T, V.

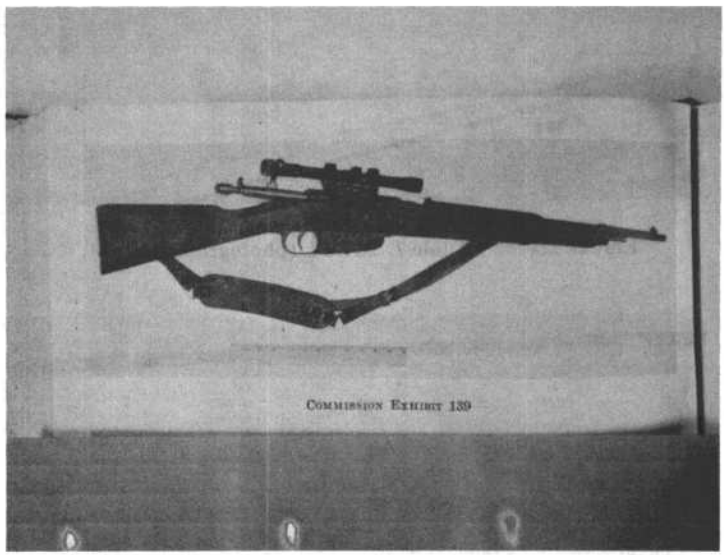


FIGURE III–3k.—Table 7. Table 1 (photograph No. 18).

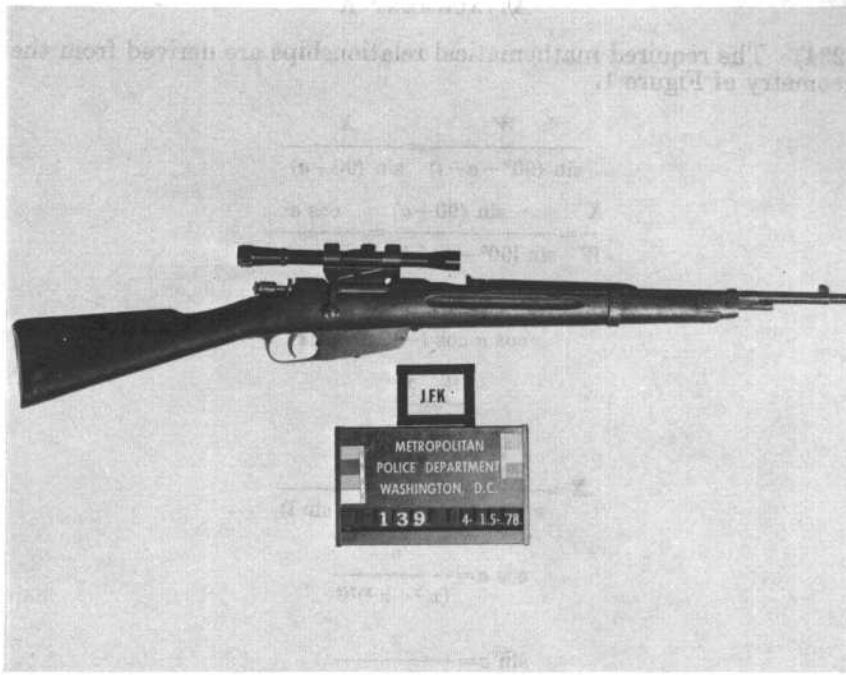


FIGURE III–31.—Table 7. Table 1 (photograph No. 20).

TABLE 8.—ERROR ANALYSIS

	Archives rifle (mm)	Mean value (mm)	Average deviation from mean (mm)	Difference from archives rifle
Part No.:				
1	465.8			
2	442.3	443.2	0.8	0.9
3	431.0	430.3	1.9	—.7
4	373.0	373.9	1.6	.9
5	355.9	355.6	1.1	—.3
6	329.7	330.7	1.6	1.0
7	188.4	187.9	1.1	—.5
8	0			
9	66.4	67.45	1.3	1.05
10	213.3	210.6	1.9	—2.7
11	261.8	262.3	1.2	.5
12	359.0	357.9	1.7	—1.1
13	553.0			

Note: Average absolute difference: 1.0 mm.

ATTACHMENT A

(234) The required mathematical relationships are derived from the geometry of Figure 1.

$$\frac{W}{\sin\,(90°-a-t)}=\frac{X}{\sin\,(90+a)}$$

$$\frac{X}{W}=\frac{\sin\,(90+a)}{\sin\,[90°-(a+t)]}=\frac{\cos\,a}{\cos\,(a+t)}$$

$$X=\frac{W\cos\,a}{\cos\,a\,\cos\,t-\sin\,a\,\sin\,t}$$

$$\frac{W}{u}=\frac{x}{v}$$

$$X=\frac{ux\cos\,a}{v\,(\cos\,a\,\cos\,t-\sin\,a\,\sin\,t)}$$

$$\cos\,a=\frac{v}{(x^{\,2}+v^{\,2})^{1/2}}$$

$$\sin\,a=\frac{x}{(x^{\,2}+v^{\,2})^{1/2}}$$

$$X=\frac{ux}{(x^{\,2}+v^{\,2})^{1/2}\left(\dfrac{v\cos\,t}{(x^{\,2}+v^{\,2})^{1/2}}-\dfrac{x\sin\,t}{(x^{\,2}+v^{\,2})^{1/2}}\right)}$$

$$X=\frac{ux}{v\cos\,t-x\sin\,t}$$ (First equation of paragraph 207)

Given:

the axial image distance v
rifle length, rear sight to the end tilted away X_1
rifle length, rear sight to the end tilted toward X_2
image length, rear sight to the end tilted away x_1
image length, rear sight to the end tilted toward x_2

$$X_1=\frac{ux_1}{v\cos\,t-x_1\sin\,t}\qquad\qquad X_2=\frac{ux_2}{v\cos\,t-x_2\sin\,t}$$

eliminate u: $\dfrac{X_1}{x_1}(v\cos\,t-x_1\sin\,t)=\dfrac{X_2}{x_2}(v\cos\,t-x_2\sin\,t)$

$$\frac{X_1}{x_1}v\cos\,t-X_1\sin\,t=\frac{X_2}{x_2}v\cos\,t-X_2\sin\,t$$

$$(X_2-X_1)\sin t=\left(\frac{X_2}{x_2}-\frac{X_1}{x_1}\right)v\cos t$$

$$\tan t=\left(\frac{X_2}{x_2}-\frac{X_1}{x_1}\right)\frac{v}{X_2-X_1}$$ (Equation in paragraph 208)

$$X_1=\frac{ux_1}{v\cos t-x_1\sin t}$$

$$u=\frac{X_1}{x_1}(v\cos t-x_1\sin t)$$ (Equation in paragraph 211)

The equation in paragraph 205 and the second equation in paragraph 207 are well known in elementary optics.

ATTACHMENT B

No. 009215.

(235) U.S. DEPARTMENT OF THE INTERIOR,
GEOLOGICAL SURVEY,
Reston, Va., May 5, 1978.

REPORT OF CALIBRATION
OF 2¼ x 2¼ CAMERA

Camera type 620 Imperial Reflex.
Lens type DUO.
Nominal focal length 77 mm.
Camera: Commission.
Identification: Exhibit No. 750.
Maximum aperture f/12.5*.
Test aperture f/12.5.

SUBMITTED BY SELECT COMMITTEE ON ASSASSINATIONS, U.S. HOUSE OF REPRESENTATIVES

Reference: Letter dated March 2, 1978 from Mr. Michael Goldsmith.

These measurements were made on Kodak Verichrome Pan film type 620, developed in D–19 at 68°F for 3 minutes with continuous agitation. This film was exposed on a multicollimator camera calibrator using a white light source rated at approximately 3500K.

I. *Equivalent Focal Length:* 77.55 mm.

This measurement is considered accurate within 0.02 mm.

II.—RADIAL DISTORTION

Field angle (degrees)	$\bar{D}_c$	D_c for azimuth angle			
		0	90	180	270
7.5	0	61	−25	−44	7
15	388	611	331	260	350
22.5	1,706			1,646	1,767

*This is a nominal value as the shutter is not equipped with either a T (Time) or B (Bulb) setting for holding the aperture in the open position.

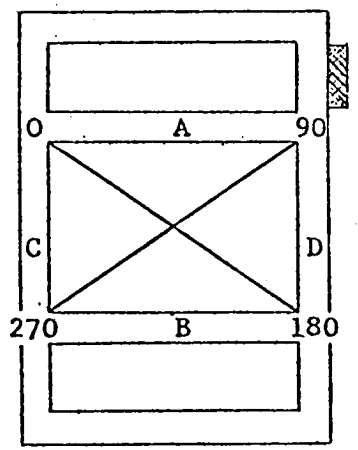
The radial distortion is measured for each of 4 radii of the focal plane separated by 90° in azimuth. $\overline{D}_c$ is the average distortion for a given field angle. Values of distortion D_c are based on the equivalent focal length referred to the field angle co-tangent for 7.5°. The radial distortion is given in micrometers and indicates the radial displacement of the image from its distortion free position. A positive value indicates a displacement away from the center of the field. These measurements are considered accurate within 10 μm. It is clear from these variations in the values reported among the four radii from the average that a substantial amount of asymmetric distortion is present in this lens.

III.—RESOLVING POWER IN CYCLES/mm

Field angle	0°	7.5°	15°	22.5°
Radial lines	14	16	20	
Tangential lines	20	20	10	

The resolving power is obtained by photographing a series of test bars and examining the resulting image with appropriate magnification to find the spatial frequency of the finest pattern in which the bars can be counted with reasonable confidence. The series of patterns has spatial frequencies from 10 to 223 cycles/mm in a geometric series having a ratio of the 4th root of 2. Radial lines are parallel to a radius from the center of the field, and tangential lines are perpendicular to a radius.

IV. Indicated Principal Point



Positions of all points are referenced to the indicated principal point as origin. The diagram indicates the orientation of the referenced points when the camera is viewed from the back. The direction of film travel is to the top.

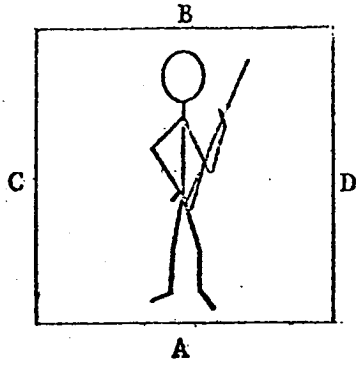
Indicated principal point to midsides of focal frame:

A	Unable to measure.
B	28.79 mm.
C	27.96 mm.
D	29.34 mm.

These measurements were made from a shadow image formed in the focal plane. The method of measuring these distances is considered accurate within 0.01 mm.

The camera was alined for calibration by autocollimating on the mounting surface where the front of the test camera-lens was placed for the film exposures. It is evident, however, that this is an indirect procedure, but the only method possible for a camera of this type. This alinement process made the front of the lens ring normal to the axis of the collimator beam emergent from the 0° collimator.

V. Camera Negative



The diagram indicates the orientation, with emulsion-up of a negative submitted for focal frame measurements.

Distances between midsides:

A–B	57.10 mm.
C–D	57.14 mm.

The method of measuring these distances is considered accurate within 0.01 mm.

WILLIAM P. TAYMAN,
Branch of Research and Design,
Topographic Division.

ATTACHMENT C

ALYEA FILM STUDY

(By C. S. McCamy)

(236) After the President was shot, the Dallas police searched the Texas School Book Depository and found a rifle. While the search was in progress, a motion picture was being made by T. Alyea of Dallas television station WFAA. I studied a 16-mm copy of that motion picture film. I did not find a satisfactory single frame displaying the entire length of the rifle. The frame selected for analysis was about 55 feet into the film. It depicts a man displaying the rifle in the book depository. The frame may be identified by a prominent lint mark on the film that is located on the image of the man's shoulder. Measure-

ments to the nearest 0.0001 inch were made on the film by means of a Nikon measuring microscope. The computed constants were: tilt angle t = 23.1° with the muzzle tilted away from the camera, object distance u = 2511 mm, and image distance v = 25.66 mm. The measured and computed distances were as follows:

Part of rifle	Image (mm)	Rifle computed (mm)	Rifle in archives (mm)
Muzzle	2.50	277.5	277.4
Front of front sight	2.30	254.4	253.9
Rear of front sight	2.19	241.8	242.6
Bayonet mount	1.71	187.2	184.6
Mount ring			167.5
Stock clamp	1.31	142.5	141.3
Front of stock band	0	0	0
Rear of rear sight	−1.88	−193.9	−188.4
Front of trigger guard	−2.58	−263.2	−254.8
Front of trigger	−4.03	−401.8	−401.7

The conformity is well within the errors that might reasonably be expected when measuring such a small film. The very large deviation with respect to the front of the trigger guard should not be regarded as very significant because that piece of the rifle curves around to meet the line of the forestock in such a way that it is difficult to see or set a hairline on where it ends. The bolt, comb, and butt were not visible in this frame.

Attachment D

Random Pattern on Oswald Rifle

(Sgt. Cecil Kirk)

(237) As a piece of equipment is utilized, either properly or abused, one can expect that the utilization or abuse will leave individual artifacts or damage on that equipment that, when evaluated together, will be found to be unique to that piece of equipment. For example, an automobile that is 2 or 3 years old provides a classic example of random patterning. The nicks and dents on the doors and sides of the vehicle are mostly caused by the doors of other cars being pushed against it in parking lots. Because the car is parked in several locations adjacent to many cars of differing sizes, a pattern of abuse will develop on the vehicle. As that vehicle is driven, it will occasionally be struck by stones and other roadway debris that add additional nicks and dents to the surface of the vehicle. Minor damage caused by insignificant accidents will add other identifiers to the random pattern which in turn will make it even more unique. These are the elements that make up the pattern of artifacts caused by utilization of the vehicle.

(238) A military rifle will also establish a random pattern on its surface. After the weapon is disposed of by the military and is sold, stored, and resold as a civilian sporting weapon it will receive other elements of its individual pattern of damage. The Mannlicher-Carcano rifle in this case displays its own pattern of identifiers—its pattern of damage. Of the numerous artifacts on this particular weapon—one mark or pattern of abuse is very distinctive. It is a rather large gouge in the forestock of the weapon. It has a measurable shape, and, because

of its depth, photographs of the rifle reflect the gouge in a manner not unlike a crater on the moon, a tire impression on a muddy road, or a tool mark in soft metal.

(239) In the Lee Harvey Oswald backyard photographs identified as 133A Stovall, 133A de Mohrenschildt, and CE–134, that same gouge is quite visible and can be measured and compared with the gouge on the questioned rifle. They are identical in every respect.

(240) Based upon this system of identification, the rifle in these photographs can be positively identified as the same rifle that is presently in the custody of the National Archives. Finally, it should be noted that although an FBI expert declined to make a positive identification of the rifle in question based upon this gouge mark, this expert did not have access to all of the same quality photographic prints that were available to the Panel. For example, the 133A de Mohrenschildt and 133A Stovall prints, both of which are of high quality, were obtained and reviewed by the committee in 1977 and 1978 respectively. This was the first time that these materials were analyzed. In addition, positive identification of the rifle was based upon an examination of CE–134, a very good enlargement (from the original negative) of CE–133A.* The FBI's expert in 1964, however, apparently did not consider this photograph in reaching his conclusion.

B. Alleged Alibi Evidence—The Billy Lovelady Issue

[See pars. 759–70 *infra.*]

*Ibid.