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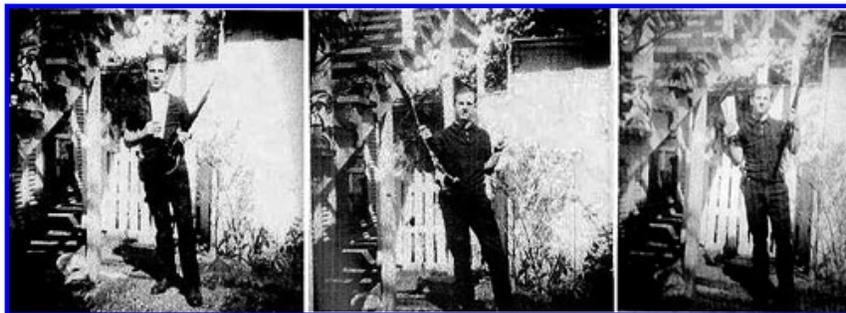
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REPORT TO THE HOUSE SELECT COMMITTEE ON ASSASSINATIONS U.S. CONGRESS--HOUSE OF REPRESENTATIVES THE OSWALD BACKYARD PHOTOGRAPHS

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The Oswald Backyard Photographs

This text refers to three views of Harvey Oswald in his backyard holding a rifle and a newspaper in his hands as shown below. Three different views are available in the Commission archives along with a single negative. Low quality reproductions of the three positive images are shown below along with a better quality reproduction of one of the views. The one negative available is of 133b and it is not shown here but it was invaluable in connecting the camera that was supposedly used with the extant negative as described below.



133 a (cropped)

133 a

133 b

133 c (cropped)

INTRODUCTION

(445) This report deals with the authenticity of the photographs of Oswald in a backyard, including prints of three different views and a negative of one of these views. Twenty-two specific questions concerning the authenticity of these photographs were presented to the undersigned by the photographic panel. Most of the questions are related to claims made by various persons in the mass media that fakery was involved in the production of the photographs.

(446) The questions are numbered and a response, with a description of the test procedures used and our conclusions, follows each question. Illustrations are included with some of the responses. The first number in

each illustration caption is the same as the number of the corresponding question. Three illustrations are also included as part of this introduction. Figure RIT 0-1 serves to identify the three different views of Oswald and the only negative that has been located. Figures RIT 0-2 and 0-3 are enlargements of two of the views which the reader may find useful for reference purposes. A glossary is included as an appendix for readers who are unfamiliar with any of the photographic terms used in this report.

OSWALD BACKYARD PHOTOGRAPHS - QUESTIONS AND RESPONSES

(447) 1. Was the negative of Oswald exposed in the Oswald camera? (The negative is identified by the Archives number CE-749, and it corresponds with the print identified by the number CE-133B. The Oswald camera is an Imperial Reflex duo lens camera that uses 620 film.)

(448) When negatives that were exposed in the Oswald camera by the undersigned were compared with the negative of Oswald, similarities in the edge markings from irregularities in the film aperture and scratch patterns indicated that the negative of Oswald was exposed in the Oswald camera. In addition, variations in sharpness from the center to the edges, and pincushion distortion were similar on the original and comparison negatives.

(449) 2. Do the edge markings on the FBI print (made from a negative exposed in the Oswald camera by the FBI) agree with the edge markings on the negative of Oswald (CE-749)?

(450) We had intended to make a quantitative comparison of the edge markings on the various photographs, as suggested by a panel member, by aligning parts of edge markings, measuring the displacement at fixed intervals and calculating the standard deviation. Careful examination of a roll of film we exposed in the Oswald camera revealed that while the distinctive marks appeared consistently on each frame of film, the straightness of the lines varied considerably—apparently due to slight buckling of the film. Instead, we made prints that compare pairs of edges on all four sides of the picture frame.

(451) By combining positive and negative images, it was possible to show the comparison as the two edges of a single black line. Figure RIT 2.1 shows a comparison between a print made by the FBI from Archives negative CE-749 (outside edge) and a print made from the same negative at RIT (inside edge). In order to show all four edges it is necessary to make the inner image slightly smaller than the outer image, resulting in a slight displacement of markings near the ends of each edge. The distinctive markings on the inner and outer edges of the black line agree closely as would be expected if the two prints were both made from the same negative.

(452) There are two obvious discrepancies that we consider to be insignificant. (1) When one edge of the two images is aligned, there is a slight lack of parallelism on the other three edges. Since the two prints were made with two different enlargers, any deviation from exact parallelism of the negative and the easel on either enlarger, a not uncommon defect in enlargers, would produce this effect. (2) There is an obvious difference in the vertical to horizontal proportions of the two images. The dimensional stability of photographic paper during processing and drying is different in the direction of the paper grain as opposed to across the paper grain. The difference in proportions is consistent with expectations if the paper grain were oriented vertically on one print and horizontally on the other.

(453) Figure RIT 2-2 shows a comparison between a print of an unidentified man on a roof made from a negative exposed in the Oswald Archives negative CE-749 by the FBI. The similarities of the markings indicate that both were made with the Oswald camera. Figure RIT 2-3 shows a comparison between film exposed in the Oswald camera at RIT (outside edge) and the Archives negative of Oswald, CE-749. Again, the

distinctive markings are in close agreement indicating both negatives were made in the same camera.

(454) 3. Are the edge markings produced by the Oswald camera unique or are they similar to markings produced by other samples of the same brand of camera?

(455) When two other samples of Imperial Reflex duo lens cameras, obtained from the International Museum of Photography at the George Eastman House (IMP-GEH), were compared with the Oswald camera, it was found that all of the bodies were produced by injection molding of plastic. This produced three circular indentations on each side of the film aperture that tended to distort the otherwise essentially straight edge. The details of the distortions in these areas, however, were distinctively different on the three cameras. These differences in-shape can be seen by examining the images through a low power (5-10X) magnifier. The most distinctive differences however, are the two projections, one on each side, near the bottom of the Oswald camera image which are missing on the two IMP-GEH cameras. Figure RIT 3-1 shows a comparison between one of IMP-GEH cameras (inside edge) and a negative exposed in the Oswald camera at RIT.

(456) 4. Does the image sharpness at the center and edges of the negative of Oswald (CE-749) appear to be consistent with that other negatives made with the Oswald camera?

(457) Yes. Photographs taken with the Oswald camera by the undersigned revealed strong curvature of field, which accounts for much of the falloff in sharpness toward the edges. Photographs made with the two/MP-GEH Imperial Reflex duo lens cameras also revealed strong curvature of field. These cameras have no focusing adjustment and no aperture adjustment to control depth of field. With curvature of field the camera focuses on nearer objects at the edges of the picture than in the center. At the distance Oswald was standing from the camera, he appears sharper than objects near the edges at approximately the same distance. If the camera had been moved somewhat closer to Oswald, however, curvature of field would cause him to appear less sharp than objects at the edges which were at the same distance. Thus, the relative sharpness at the center and edges of photographs made with these cameras varies with the object distance. In figure RIT 4-1, the curved plane of sharp focus in object space is behind the wall in the center causing unsharpness in this area, is at the wall in a circular area midway between the center and the edges producing a sharp image, and is in front of the wall at the edges again causing unsharpness.

(458) 5. Could the scratches on the negative of Oswald have been produced by the Oswald camera?

(459) Film exposed in the Oswald camera by the undersigned revealed scratches similar to those on the original negative of Oswald. Some scratches did not extend the full length of the film, but when 8 x 8 inch prints made from the original negative and one of the above comparison negatives were carefully aligned, four prominent scratches were in the same locations on both prints--at 36, 45, 52, and 112 mm from the left edge of the picture area (fig. RIT 5-1). Scratches were detected on both the emulsion side and the base side of the negative of Oswald (CE-749), but the scratch lines that are evident on the prints correspond to those on the emulsion side of the negative. The fact that four prominent scratches were in the same locations on a print made from the negative of Oswald and a print made from a negative we exposed in the Oswald camera completely satisfied us that the scratches on the negative of Oswald were produced by the Oswald camera.

(460) 6. Do other samples of the same brand of camera produce similar or identical scratches?

(461) Obvious scratches were produced by one of the two imperial Reflex duo lens cameras obtained from IMP-GEH but not by the other (figs. RIT 6-1 A and B). The camera that produced the obvious scratches had a badly warped back that put excessive pressure on the film and made it difficult to advance the film. The scratch pattern produced by this camera was not at all similar to that produced by the Oswald camera. We

conclude that film scratching with this brand of camera is not the result of a manufacturing defect, in which case similar scratch patterns could occur with different cameras, but rather is the result of changes that may occur on an individual basis as the cameras are used over an extended period. It seems that the plastic used in the camera body and back can soften and be deformed when subjected to elevated temperatures, as was evident. on one of the two IMP-GEH cameras, placing excessive pressure on the film as it is advanced in the camera.

(462) 7. Can the scratches on the negative of Oswald be enhanced?

(463) There are procedures for enhancing scratches. Since it was felt that a positive identification had been made in the response to question 5 above, these procedures were not employed. Also, we noticed that the fine scratches on the film we exposed in the Oswald camera tended to be less continuous than the four obvious scratches we measured and therefore they would be less useful for identification purposes.

(464) 8. Are any scratches continuous on the body, head, and background on the negative of Oswald?

(465) Apparently there was concern about the scratches not only for the purpose of determining if the negative of Oswald had been exposed in the Oswald camera (discussed in 5 and 6 above) but also to provide information concerning the possibility that a composite image had been made--such as a head or figure from one photograph and the remaining parts from another. For this second purpose, a continuous scratch on the head, body, and background would limit the options by which a composite could have been made. If, for example, a scratch were detected running from the top edge to the bottom edge of a print but stopping abruptly at the head, there would be reason to suspect that a head had been transplanted from another photograph. Or, if such lines were detected on the negative of Oswald but they were evident only as light or dark streaks with no indication of physical damage to the film surface, there would be reason to suspect that the negative was a copy negative rather than an original, and that some fakery was involved. No evidence of such scratch marks was detected. In the present case, since it could be seen that the scratches were actually on the surface of the negative of Oswald, they simply confirm these marks were caused by the camera and, as such, that the negative was indeed exposed the Oswald camera. None of these scratch marks were suggestive of compositing. Similarly, the scratch marks on the prints were caused by the effect of the camera on these negatives, and thus are not evidence of fakery but rather serve to confirm that Oswald's camera was used to take these pictures.

(466) 9. Are there any differences in the grain pattern in the areas of the body, head, and background on the negative of Oswald

(467) No inconsistencies could be detected between the areas mentioned with examination of the original negative through a 30X magnifier, on normal contrast enlarged prints, or on high contrast enlarged transparencies (figs. RIT 9-1 A and B).

(468) 10. Are the backgrounds identical in the three different views of Oswald in the backyard (CE-133A, CE-133B, and CE-133C)?

(469) The backgrounds are not identical on the three photographs, but the differences are those to be expected as a result of a change in the position or the angle of the camera with respect to the scene. We could not detect anything that would suggest the background itself (as distinct from the photographs of the background) had been changed in any way--as by the addition, removal, or alteration of any of the parts. Also, we could not detect any evidence of fakery either in the background areas of the photographs or in the figures. (Also see

question 15 below.)

(470) 11. Are the nose shadows compatible with the other shadows the scene?

(471) The positions of the shadows under the nose, eyebrows, and chin all appear to be consistent with the other shadows in the scene. In addition, the sharpness of the edges of the shadows and the contrast of the shadows with the surrounding areas appear to be consistent.

(472) We were subsequently asked to respond to the statement in the Caption on page 191 of JFK: The Case for Conspiracy by F. Peter Model and Robert 3. Groden, which compared CE 133-A and 133-B. "In the bottom photo CE 133-B, Oswald's head is cocked slightly to his left, yet the shadow directly under his nose (see top closeup of CE 133-A) moves--not in relation to the light source but to the angle of his head.

(473) It is true that if the tilt of the head were the only change made between the two photographs, the nose shadow would point more toward the left of Oswald's mouth (on the viewer's right) in CE 133-B where the head is tilted. However, turning the head from left to right (as distinct from tilting it) also alters the placement of the nose shadow. The authors understandably did not take this factor into account because Oswald's head seems to be facing directly toward the camera on both photographs. In actuality, however, the position of Oswald and/or the camera has changed as evidenced by the change in the position of the post behind Oswald. If we assume that the camera was moved a short distance to the viewer's left, for CE 133-B, Oswald would have to turn his head to his right in order to be facing the camera and this would move the shadow back toward the original position shown in CE 133-A. Also, moving the camera to the left or moving Oswald to the viewer's right would produce the observed change in the relative positions of the post and Oswald's head.

(474) Four photographs were made of a manikin head to illustrate the explanation given above: Figure RIT 11-1. The nose shadow falls straight under the nose with the head in the vertical position.

Figure RIT 11-2. Tilting the head to the viewers right by placing a pencil under the opposite side causes the nose shadow to move noticeably toward the left side of the manikin's mouth. Figure RIT 11-3. Rotating the head to its right returns the shadow to the original position, but the manikin is no longer facing the camera. Figure RIT 11-4. Moving the camera to the left produces a full front view of the head with the shadow in the original position even though the head is tilted. Also, the background has moved to the left in comparison with the head, as in the photographs of Oswald.

(475) 12. Is there any evidence of a line in the chin and neck area that would suggest the picture is a composite?

(476) We found no evidence of a line suggesting a composite had been made in our examination of the only original negative available (CE-749) (without magnification and at 30X magnification) and of normal-contrast prints and high-contrast prints at either low or high magnification. We made a copy of the reproduction of a portrait of Oswald from page 192. "JFK: The Case for Conspiracy," by F. Model and R. Groden in which the authors claim the chin has been transplanted (fig. RIT 12-1). For comparison purposes we made enlargements at about the same scale from copy negatives of prints CE-133A, CE-133B, and CE-133C (fig. RIT 12-2). The enlargement of the head from CE-133C is less sharp than the other enlargements because when the original 8 x 10 inch print was made, the enlarger was not focused accurately, and the original negative has not been located.

(477) All three of these prints have light shadows on both sides of the dark shadow under the lower lip, but

print CE-133A also has some irregular dark spots in the area where the line appears in the book illustration. Such spots could be caused by any of various natural factors, the most probable of which are shadows caused by the slight but obvious change in expression in the mouth area, random clumpings of silver grains which are evident at this magnification throughout the pictures and a slight change in the angle of the head with respect to the Sun.

(478) In any event, the dark spots on our print do not conform to smooth line which would be the effect with the conventional procedures used in making composite images. A line can also be seen on the forehead of this photograph (CE--133A) which does not appear in CE-133B nor in the book illustration. The picture that appears in the book was made with high-contrast film or paper, an appropriate procedure for some purposes but it produces a misleading effect here in that it exaggerates some details and eliminates others. Observe that the laugh lines running down and out from the sides of the nose, which are plainly visible on our normal contrast print, have disappeared in the book illustration. We are convinced that there is no fakery associated with the spots on the chin.

(479) 13. Are there any pictorial inconsistencies that suggest faking?

(480) Careful examination of the photographs with respect to lighting, perspective, sharpness, distortion, grain pattern, density, and contrast revealed no evidence of fakery. Examples of evidence of fakery concerning the lighting would be shadows in the wrong position in relation to the position of the Sun and the object casting the shadow, shadows that do not correspond in shape to that expected when shadows are projected onto another surface, shadows that do not appear as sharp as expected with direct sunlight, shadows that do not appear dark as expected with the approximately 1:8 lighting ratio between shadow and highlight sides of objects obtained in sunlight on a clear day, and shadows that do not respond to nearby reflecting surfaces. No such discrepancies are seen in any of the three photographs of Oswald. The darkness, shape, sharpness, and placement of the shadows appear to be correct.

(481) The effect of light being reflected from the white surfaces on the left can be seen in the shadow on that side of Oswald's neck, and the shadow of Oswald on the ground moves appropriately as he changes his position between each of the photographs. Tilting the camera slightly downward for view CE-133A where Oswald is holding the paper under his chin produces the expected higher placement the figure in the picture and the divergence of the vertical subject lines towards the top of the picture.

(482) Composite photographs made using a pastepup or montage technique can usually be defected as such unless the component parts are made under identical conditions and with great skill. Clues that commonly reveal fakery are mismatches of the density, contrast, sharpness, graininess, perspective, and lighting, and imperfect blending of the edges between the parts. No such clues can be found in these photographs. Furthermore, there is no disruption of the grain pattern across the boundary between the head and the body or between the head and the background so that any composite photograph involving the head would require using large original negatives and prints and then copying a composite image with the Oswald camera. This possibility is discussed in the response to question 22, but nothing in the negative or the three prints of Oswald was detected that appears inconsistent or Suggests fakery.

(483) Additional questions related to statements by Mr. Malcolm Thompson in a BBC film and a manuscript identified as "Panorama -- Kennedy, Project. number 5348/5506" that is included in the appendix:

(484) 14. Does the apparent bulge in the left edge of the post to the right of Oswald's head appear to be due to retouching or other alteration of the image in photograph number CE 133B?

(485) What could be perceived as an indentation in the post in CE-133B is believed by the undersigned to be an illusion resulting from the location of a shadow of a branch or leaf along the left edge of the post. It follows that since the darker area to the left of the post is a shadow of the post on a white surface, a shadow falling on the white post would be similar in tone and could be seen as part of the background rather than as a shadow on the post. The shadows falling along the right edge of the post create a slight illusion that the right edge is not entirely straight either even though the background to the right of the post is lighter in tone.

(486) Careful examination of this area on enlarged prints reveals a narrow object, that could be either wire or a bush branch, running from the edge of the building on the right, in front of the post, across the area in question, and continuing through the shadow area between the neck and the post (fig. RIT 14-1). Anyone skillful enough to retouch the area between the neck and the post, as claimed by Mr. Thompson, and include the just-detectable wire or branch, would have no difficulty in producing a straight line on the post.

(487) 5. Are the backgrounds and shadows identical on any of the three different views (CE 133A, CE 133B, and CE -133C), thereby suggesting that different figures have been superimposed on different prints of a single background photograph?

(488) The speculation is either that someone started with a photograph of a backyard with no figure and added the three figures from other photographs, or that Oswald's head was added to three photographs, of someone else standing in the backyard. The backgrounds are not identical, thereby ruling out the possibility that figures were added to three prints of a single photograph of the backyard. The differences include changes in the convergence of vertical subject lines (the posts, the boards in the fence, and the building on the right) with changes of camera tilt, changes in the area of the background included in the three views, and slight changes in the positions of shadows of some branches and leaves.

(489) 16. Is there evidence that part of the background could have been moved photographically to fill a gap created by adding a figure in a different pose to a background photograph?

(490) No such evidence can be detected. Since the figure moved to the viewer's left between views CE-133B and CE-133A, and moved closer to the fence between views CE-133A and CE-133C, major gaps would have been created around the entire periphery of the figures if the figures had been added as suggested. Even if it is assumed that photographs of Oswald's head have been added to photographs of someone else's body, the necessary retouching around the edges would be difficult to conceal from detection with high magnification.

(491) 17. Is there evidence that the shadows have been touched in? No. The shadows appear normal in shape, location, sharpness and contrast. It would be especially difficult to maintain realistic detail in the shadows on the ground if the shadows were added. It is noted that the shadow moves an appropriate distance to the left as Oswald moves to the viewer's left from view CE-133B to view CE-133A, and when he moves closer to the fence in view CE-133C the shadow moves up onto the fence as expected. (The relative distances between Oswald and the fence can be determined by noting the position of his feet with respect to the shadows of the three overhead wires.)

(492) It is true that highly skilled artists can and have made paintings that appear photographic. There is no evidence, however, that this was done in this case. To add shadows having detail to a photograph requires not only darkening the appropriate area, but also changing the detail within the shadow so that it appears to be illuminated by diffuse illumination from the sky and surroundings rather than by the Sun. Therefore, the sharpness and position of the detailed shadows within the larger shadow area must be changed in sharpness

and position. For example, there is a ridge at the top of the white wall behind Oswald that casts a shadow on the wall beneath it. Where the Sun hits the ridge the shadow is sharp and contrasty. Where the ridge is in the shadow of the post, the shadow has a less sharp edge and the contrast with the adjacent area is lower. A similar situation exists where Oswald's shadow falls on what appears to be a paper on the ground near the fence. The soft shadows on the paper within the head shadow on view CE-133B appear as would be appropriate if illuminated with diffuse light from the fence and sky.

(493) 18. Is the size or position of the shadow of the gun in Oswald's right hand (view CE-133B) inconsistent with the position of the gun?

(494) If the gun were held vertically with the butt on the hip, we would expect the shadow to be oriented in the same direction as the shadows of the legs. However, the barrel of the gun is tilted toward the left side of the picture and also toward the camera. Both of these changes have the effect of rotating the shadow of the gun in a counter-clockwise direction. The positions of the gun and the shadow are therefore compatible.

(495) 19. Is there evidence that, Oswald's left arm and hand have been stuck on to another photograph in a physiologically inconsistent manner (view CE-133B)?

(496) It is possible to experience an optical illusion whereby the small wedge of the bare upper arm that is visible between the bottom edge of the dark sleeve and the lower arm appears to be part of a horizontal limb attached to the rib cage. This is an illusion not unlike the illusion in view CE 133A that the post is sitting on or growing out of Oswald's head. It is just as easy to see the small wedge of the bare upper arm as being part of a vertical limb that is mostly enclosed in the shirt sleeve. Moreover, it is difficult to understand the purpose of making a composite image in this manner.

(497) 20. Is the area between Oswald's neck and the post to the viewer's right (view CE-133B) too wide to be filled by a shadow of the post, thereby indicating retouching?

(498) The ratio of the shadow width to the post width was calculated for view CE-133A where both are clearly visible, and was found to be 1:1.07. Applying the same ratio to an enlarged print of view CE-133B, where the post is 24 millimeters wide, the calculated width of the partly concealed shadow is 22.4 millimeters. The measured distance between the neck and the post is 22 millimeters if the apparent indentation is included, and only 20 millimeters to the position of a straight left post edge. Therefore, the distance between the neck and the post is not too wide to be filled by a shadow of the post.

(499) 21. Are the heads on any two of the three different views (CE-133A, CE-133B, and CE 133C) from a single original photograph ?

(500) One method of detecting differences between two photographs is to place them in a stereoscope so that the left eye sees one photograph and the right eye sees the other. If the two photographs are identical, the two images will fuse and the viewer will perceive a single image. If the photographs are not identical, the areas of disparity will not fuse and the viewer will perceive two separate images. When the three views of Oswald were viewed two at a time in a stereoscope, it became apparent that no two of the images were identical.

(501) The procedure used in the CBC film to demonstrate that the heads on two of the photographs of Oswald were identical was to superimpose enlarged monochrome color transparencies having different colors. The viewer was thereby led to believe that the transparencies registered exactly. In an effort to duplicate this demonstration, we made closeup copy negatives of the head areas in the three prints identified as CE-133A, CE-133B, and CE-133C. These negatives were enlarged to 8 x 10 inches to produce diapositive images on

normal-contrast film and also on high-contrast film. Green and magenta positive images were then produced by contact printing.

(502) Superimposing the normal-contrast color images from the pairs of photographs as was done in the CBC film revealed that while this appears to be an elegant test, it is not very discriminating. The registration between the two images could be altered considerably before any color fringing became apparent in the facial features. An explanation for this registration tolerance is that the facial details that appear sharp on a small print are revealed to have unsharp edges when enlarged to this size due to the granular composition of photographic image. A close examination of the superimposed images revealed a difference in the grain structure, but color differences were obvious at a normal viewing distance only in the large areas of disparity in the background and under the head (fig. RIT 21-1).

(503) Two additional procedures were then used in an effort to verify and then provide evidence that the heads on the three photographs are not identical. For one, positive and negative high-contrast film images were sandwiched together and contact printed onto paper. When the positive and negative images are from the same original photograph (CE-133B) a fine-line effect is produced as shown in figure RIT 21-2. When the positive image from CE-133B is combined with the negative image from CE-133A, the areas of disparity are represented either as broader black areas or as broken lines. This print is shown in figure RIT 21-3. Similar comparisons of CE-133A and CE-133C, and of CE-133B and CE-133C are shown in figure RIT A and B.

(504) It should be mentioned here that the head sizes were not identical on the original prints from the Archives. An adjustment was made when the copy negatives were enlarged to make the 8 x 10 inch diapositives. The widths of the images were matched at the temples and cheekbones, but the vertical-horizontal proportions are noticeably different. We attribute this change in the shape of Oswald's head to the downward tilt of the camera for photograph CE-133A, that placed the head farther off the lens axis. This effect is explained in greater detail below.

(505) In addition to the change in the outline shape of the head, the disparity between the images in the area of the nose, mouth, and shadow under the mouth is quite obvious. We attribute these differences to a slight change in expression around the mouth and a slightly different angle of the head with respect to the Sun and the camera. The chin shadow appears in the shape of an inverted "U" in CE-133B and an upright "U" in CE-133A.

(506) For the third and final procedure demonstrating that, the heads on the three photographs are not identical, negative and magenta transparencies were made from the positive and negative high-contrast film images. When the green image from CE-133B is properly registered (i.e., superimposed) on the magenta image from CE 133A and the two are opposite in negative-positive polarity (i.e., one is a negative image and the other is a positive image), the areas of disparity become evident as clear areas and as areas of a darker color produced by the overlap of green and magenta. We believe the differences are dramatic and clearly indicate that the two heads did not come from a single original photograph. This pair of images is shown in figure RIT 21-5. Similar results were obtained when high-contrast, color images from view CE-133C and CE-133B (fig. RIT 21-6). An additional pair of green and magenta transparencies, both made from view CE-133B, is included to show the appearance of identical images in figure RIT 21-7.

(507) Additionally, photographs were made of a manikin head with an Imperial Deluxe Reflex duo lens camera similar to the Oswald camera, placing the image of the head in various positions from the center of the negative to the edges. The purpose of this was to illustrate the effect such variations in placement have on the shape of the image of the head in order to explain the differences in head shapes in photographs CE-133A, CE-133B, and, CE-133C, observed when the high-contrast color transparencies were superimposed. A black and

white contact print of three negatives (fig. RIT 21-8) shows the manikin head in the center of the photograph, near the top (tilting the camera down), and near the top left corner (tilting the camera down and aiming it, to the right). Placing the image of the head off the lens axis causes it to be elongated in a direction radiating away from the center of the photograph. Thus, the head at the top of the photograph is stretched vertically and the head in the corner is stretched diagonally. This change in shape can be seen on the contact print but the heads were also enlarged on high-contrast film and contact color transparencies were made so that direct comparisons could be made by superposing green and magenta pairs of the three images. (fig. RIT 21-9).

(508) This change in shape is known as the wide-angle effect and it occurs with all conventional camera lenses including normal, wideangle, and telephoto, but it is most obvious with short focal length wide-angle lenses. In addition, pincushion distortion, which is evident in the curved reproduction of straight subject lines, and the altered perspective, which is evident in the convergence of vertical subject lines when the camera is tilted, slightly affect the shape of the head. (The differences in sharpness of the images of the manikin head when placed in the center and near the edges of the photograph is further evidence of curvature of field observed in photographs made with the Oswald camera.) Thus, the difference in height to width proportions of the heads in CE-133A, CE-133B, and CE-133C can be explained in terms of these effects since the tilt of the camera changed between the photographs, thereby placing the head in different positions. Of the three effects mentioned, the wide-angle effect, has the greatest influence on the shape of the head. Since the wide-angle effect applies only to three-dimensional objects, it would not alter the shape of the two-dimensional head on a photographic poster or print, which has been suggested as a way off faking the photographs of Oswald. Thus, the presence of this effect in the backyard picture is another item of evidence negating the likelihood of fakery.

(509) 22. Could the negative of Oswald be a copy of a composite print rather than an original photograph?

(510) The undersigned copied a photographic print with the Oswald camera, using a +4 diopter supplementary lens over the camera lens, to demonstrate that it is possible to make a copy negative that has characteristics of an original negative including edge markings, scratch patterns, variations in center to edge sharpness, pincushion distortion, and consistent grain patterns (fig. RIT 22-1 A and B). For this type of fakery to be successful, it would be necessary to use a large format camera with a good quality lens for the original photographs to avoid introducing graininess, scratches, unsharpness, or distortion at this stage. Also, any alterations would have to be made on large photographs so that retouching or discrepancies could be concealed. Furthermore, the Oswald camera would have to be available to the person making the fake photographs and it would be necessary to calculate a combination of supplementary lens focal length and original print size to obtain an in-focus image of the desired size with the fixed-focus camera.

(511) Clues that might uncover this type of fakery would include strong pincushion distortion caused by adding a supplementary lens, loss of graduation in highlight areas and loss of detail in shadow areas which typically occurs when copies are made, and possible detection of imperfect retouching or other alterations. Pincushion distortion was much more evident on the copy photograph made with the Oswald camera than on the original negative of Oswald or on other photographs made with the Oswald camera without the supplementary lens. Since there is no wide-angle effect when two-dimensional photographs are copied, to avoid detection of fakery, appropriate variations in the shape of Oswald's head would have to be incorporated in the original photographs. In summary, it is possible to make copy photographs that are acceptable as originals. Nevertheless, because such a process poses many technical problems, any one of which if not solved would lead to detection under close examination of the photographs, we do not believe such a procedure was used to produce the three, backyard photographs of Oswald.