

CASE REPORT

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Homicide with a Black Powder Handgun

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ABSTRACT: A young white male was found shot to death in the entry hall of his home. The nature of the projectiles found in the body and the appearance of unusual residues on the walls of the hallway suggested that a percussion cap black powder weapon had been used. Interviews with acquaintances of the victim also suggested that a percussion cap revolver may have been involved, and it became of critical importance to reconstruct the circumstances of the crime, since the weapon itself was not recovered. Weapons similar to that allegedly used were test-fired under controlled conditions and residues from the muzzle and cylinder blast were compared to residues at the scene. Based upon these comparisons, standard distance determinations, the pathological findings, and the characteristics of the recovered projectiles, the dynamics of both victim and perpetrator could be reconstructed. Their relative positions and the sequence of shots were also reconstructed. The comparisons conducted in this case revealed that black powder revolvers produce large amounts of unusual residues which supplement the usual range of firearm evidence to make even complex reconstructions possible.

KEYWORDS: criminalistics, ballistics, homicide

Description of Crime Scene

The body of a young white male was found sprawled in the narrow entry hallway of his residence by his girlfriend. The body was slumped on the floor, its head, neck, and upper torso leaning against the door with the lower torso and legs extended into the hallway. The decedent had been last seen by this same witness at approximately midnight the night before. The victim was still wearing only blue denim pants and undershorts as when last seen. He appeared to have been dead some hours; there was an extensive pool of blood extending from a wound in the upper right leg and additional blood from the face and upper torso pooling on the floor from an apparent wound to the head.

Found on the north and south walls of the hallway were four discrete areas of grey and black "speckling." These deposits appeared to be fresh to the scene as in several cases they overlay fresh paint on the door trim. These areas were roughly elliptical in outline and were located in the areas noted in Fig. 1. Although each was an area of random, diffusely scattered speckles of material, they varied considerably in their intensity. The two areas at Positions A and D of the figure were larger in overall dimensions and each contained a larger

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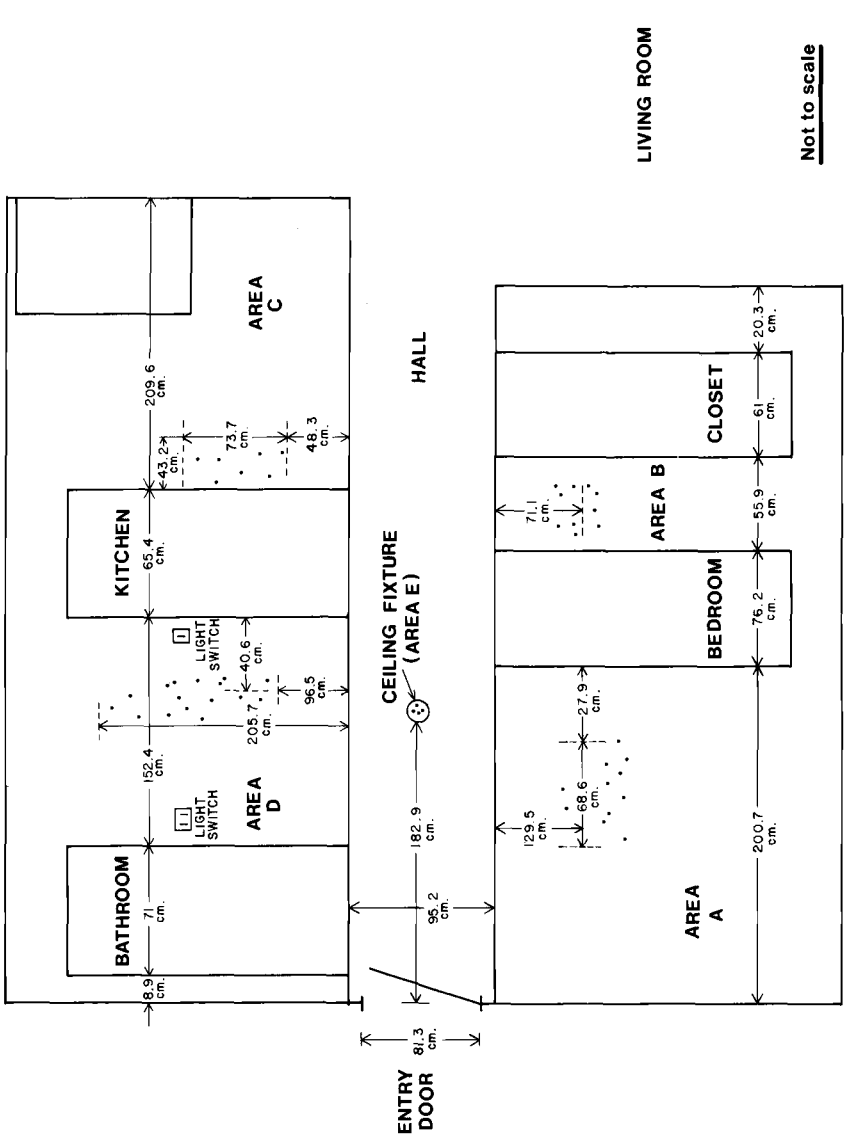


FIG. 1—Plan view of crime scene showing deposits on walls and ceiling fixture.

number of individual flecks of material than the patterns in Areas B and C. The deposits in Area B were centered around a point closer to the floor than those at A and D. While the deposits at C were centered at roughly the same height as B, they were very diffuse and were, in fact, not detected during the first examination of the crime scene. A fifth, very limited, area of what appeared to be similar specks were noted on the globe of the light fixture located approximately 1.8 m (6 ft) from the entrance door and centered roughly over the center of the patterns at Areas A and D.

Upon closer inspection of the individual speckles of material, they appeared to be of two general types. The first was a grey to black grease-like material which had in fact partially soaked into the absorbent wall surface. These deposits were later to be found to be indistinguishable from the residues of the propellant-contaminated lubricant used in black powder weapons. The second type of material appeared to be discrete particles of a grey to black solid. When recovery of these particles was attempted, it was discovered that they were in fact a solid ash that was so brittle it could not be recovered as a discrete particle in most cases. On the wall, surrounding many of these particles, was a minute halo, or ring, of dark grey smoke. These deposits were later to be found to be indistinguishable from fragments of black powder which in many cases are still burning as they leave the weapon. Those particles that strike the surface while they are still burning will often lodge and continue to burn. The solid ash may remain intact while the lighter combustion products form the tiny halo surrounding the particle. Although these deposits, like those of the lubricant, were sampled at the scene using a cotton swab dampened with acetone, no specific examinations of these swabbings were carried out by the author's laboratory.

Also found on the north wall of the scene was a semicircular blood smear starting on the right side of the bathroom door frame and extending across the wall and across the light switch which controlled the hall light previously mentioned. Although samples of this smear were taken for comparison with the decedent's blood, bloodtyping tests were inconclusive. The smear turned out to be more significant from the standpoint of the reconstruction as we will see later. The direction of the smear could be estimated from the "skipping" of the smear as it moved over the corner of the door frame, the light switch plate and the toggle of the switch itself, as can be seen in Fig. 2.

The door to this bathroom was standing open and in the very corner of the door, at a spot 1.65 m (5.5 ft) above the floor, was found a metal fragment imbedded deeply into the wood. This door was photographed in place and then removed to allow recovery of the metal fragment in the laboratory.



FIG. 2—Dried smear of blood across bathroom door frame and light switch, north side of hall.

Laboratory Examinations

Pathology Findings

The body of the decedent was examined by Dr. Pierce Rooney of the Sacramento County Coroner's Office who conducted the postmortem examination. These findings included a total of three related scalp wounds (see Fig. 3), the first of which appeared to be an entrance wound approximately 25 mm (1 in.) above the outer corner of the left eyebrow with a second smaller wound above and to the left of it. A third scalp injury appeared to be an exit wound from a projectile fragment exiting the left temple approximately 51 mm (2 in.) from the entrance wound. A projectile striking the skull above the left eye appeared to have been broken by the impact with one large fragment exiting the scalp, a smaller fragment producing the second injury, and the largest portion continuing on through the skull traversing the left hemisphere of the brain. This badly damaged projectile fragment was recovered during the postmortem examination. Small speckles of a dark greasy material were noted on the forehead, eye, nose, and left cheek of the decedent in the area approximately 127 mm (5 in.) in radius from the entrance wound. The trajectory of the entrance projectile and subsequent fragments would be roughly parallel to the floor if the subject were standing and facing straight ahead at the time he was shot. A small abrasion on the right side of the nose, showing traces of recent bleeding, appeared to be contemporary with the major wounds.



FIG. 3—Close-up of wounds in victim's forehead after removal of blood and residues.

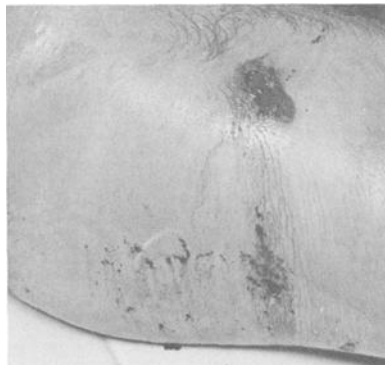


FIG. 4—Wound in upper right thigh.

A second entry wound was located in the front of the right upper thigh. The appearance of the entrance wound indicated that the projectile struck the skin at an upward grazing angle leaving an abraded margin on the lower right edge and a plowed, broken surface in the upper leftmost edge as shown in Fig. 4. The wound track on the inside continued through the pelvic arch, upwards across and towards the left side of the abdominal cavity. The projectile, largely undamaged, was recovered from under the skin in the vicinity of the upper left back. Several flecks of dark greasy material were noted on the bare skin of the lower abdomen, extending approximately 305 mm (12 in.) above the entrance. Since most of the area surrounding the entrance wound was covered by the denim pants, those pants were recovered and submitted to the laboratory for examination. Some samples were taken from the particulate material adhering to the victim's face but were later found to be insufficient for laboratory analysis. No samples were taken of the few fragments of material on the abdomen.

Firearms Evidence

The lead fragment recovered from the back of the decedent was a lead projectile, roughly cylindrical in shape, weighing 134.4 grains. It bore a series of longitudinal rifling impressions which were consistent with having been produced by a weapon having seven lands and grooves. The direction of twist could not be readily determined from the impressions because of slippage and multiple overlying "leading edges." The diameter of the rifled dimension of the bullet ranged from .421 to .436 in. One end of the projectile bore stippling and discoloration; the opposite end bore an oval tool impression concentric with the circular dimension of the projectile (see Fig. 5). The land impression width could not be accurately determined as a result of slippage of the bullet and deep grooves apparently produced by sharply burred edges of the lands of the weapon. The rifling dimensions of this projectile were consistent with those produced by percussion cap revolvers of nominal .44 caliber. The oval impression on the grooves of the bullet results from the use of the loading ram in the revolver to seat the projectile and powder in the chamber. (See Fig. 6 for an illustration of typical loading ram.)

The two fragments recovered from the head were identified as lead projectile fragments bearing severe impact damage and some stippling, but no rifling impressions. The two fragments weighed a total of 80.6 grains. The metal fragment from the bathroom door was identified as lead of similar composition to the other projectile fragments. It bore no rifling impressions and weighed 40.7 grains. These fragments, together, were thought to represent fragmented remains of a single lead projectile similar to that found in the decedent's back. Together they weigh a total of 121.3 grains which compares favorably to the weight of intact projectiles recovered after having been fired from .44 caliber revolvers, which range from 134 to 138 grains. Because of the bulk production of lead projectiles of this type, elemental

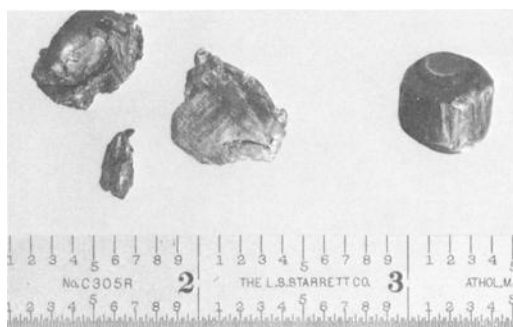


FIG. 5—Projectiles and fragments. from right to left: intact projectile from victim's back, fragment from bathroom door, fragment from forehead wound, and fragment from skull. 1 in. = 25.4 mm.

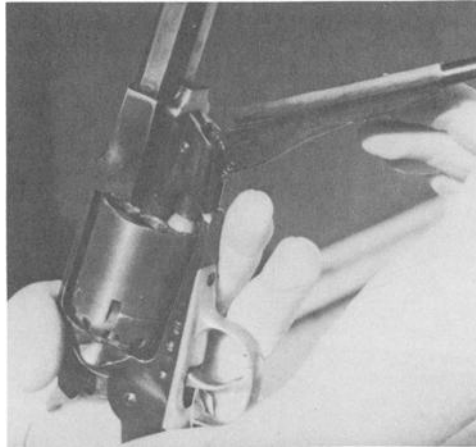


FIG. 6—Use of loading ram to seat bullet in black powder revolver cylinder.

analysis was considered to be of minimal potential value in determining a common origin of these fragments and was not conducted. Preliminary surveys of these fragments revealed that they were almost entirely of lead, with minimal content of other alloying metals. It was later learned that projectiles intended for use in black powder weapons are intentionally made very soft; that is, with little antimony or tin hardening added, and the splitting behavior of the projectile upon impact with the skull was typical of such soft lead projectiles.

The pants of the decedent bore an irregular hole in the front of the right leg approximately 203 mm (8 in.) below the waistband. The lower margin of this hole was frayed and torn whereas the upper margin was more cleanly defined. The appearance of this hole indicated that a projectile of moderate caliber (.38 to .45) entered the fabric on an upwards track from front to rear. This appearance was consistent with the wound track described in the pathology report. Because of the extremely heavily bloodstained fabric, no chemical analysis was carried out for the presence of gunshot residues. A careful microscopic examination of the area revealed no particulate matter. It should be noted that black powder residues are not as distinctive in appearance as the residues of partially burned smokeless powder in that they are small irregular chunks that look like coal or charcoal and can be easily overlooked even during the most careful examination. Since black powder is a mechanical mixture of sulfur, potassium nitrate, and charcoal, the potassium nitrate is soluble in water or blood and can be leached out leaving a visually nondescript residue.

Two percussion cap revolvers typical of the two basic varieties available were obtained for examination. These are illustrated in Fig. 7, one being an F.I.E. replica of the Navy revolver, having no topstrap above the cylinder. The weapon has a nominal caliber of .44 in. The projectiles recovered from test fires of such a weapon have a land diameter of .435 to .442 in. The second weapon was a Ruger "Old Army" revolver having a normal topstrap over the cylinder, in nominal .45 caliber. Test fired projectiles from this weapon had a land diameter of .443 to .451 in. The F.I.E. revolver has seven lands and grooves and a righthand twist with a land width of approximately .088 in. The statements of other individuals involved in the case suggested strongly to investigators that this was the type of weapon most likely responsible for the shooting.

Normal loading procedures for the .44 caliber weapon call for approximately 20 to 25 grains of black powder. A lead ball of .451-in. caliber is placed in the mouth of the cylinder and forced down onto the powder by use of the loading ram mounted beneath the barrel. This results in a tool impression on what will be the nose of the projectile which can, in some

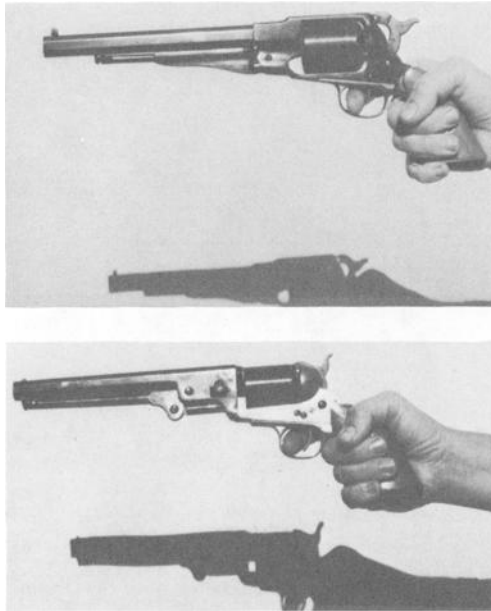


FIG. 7—(Top) "Army" .45 caliber replica revolver with top strap and (bottom) "Navy" .44 caliber replica revolver without strap.

cases, be matched to the loading ram that produced it using normal tool mark impression criteria. A properly fitting spherical projectile seated in such a weapon usually leaves a small ring of lead on the face of the cylinder. When the lubricant and chamber sealant is spread into the chamber with the finger, this ring of lead is sometimes broken up and pushed into the chamber along with the projectile itself. This may account for small secondary wounds such as that noticed on the right side of the nose of the decedent in this case. The Ruger .45 caliber weapon is normally loaded with a larger caliber ball (.457 diameter) but it can be fired using the .451-in. ball as used here. Since it is a looser fit in the chamber it offers less resistance to the loading ram and the resulting tool impressions on the nose of the projectile are faint or nonexistent. In either case, when the weapon is discharged the burning black powder produces a characteristic discoloration of the surface of the projectile facing it and a ragged pocking or stippling of that same metal face. These characteristics can be used to help identify a projectile as having been discharged from a black powder weapon.

These weapons were loaded in a normal manner and discharged within a paper tunnel as shown in Fig. 8. The axis of the tunnel is coincident with the direction of the projectile, and the surrounding paper offers a reproducible means for examining the residues discharged in *all* directions around the weapon. It was discovered that when one chamber of a cylinder of such a weapon is loaded in the normal manner and discharged, it produces a small spray of lubricant, partially burned powder, and other discharge residues along the face of the cylinder as in Fig. 9. Gases escaping from the gap between the cylinder and the forcing cone of the barrel spray particulate residue in all directions from the weapon except where it is intercepted by the frame or top strap. Although this effect occurs in all revolvers, it is especially apparent in black powder weapons because of the volume of unburned and partially burned propellant residues and because of the presence of the lubricant in large quantities. (This lubricant may be a proprietary mixture of various natural waxes and oils concocted by the shooter, one of several commercially made products or even such common household



FIG. 8—Test discharge of weapon in paper tunnel.

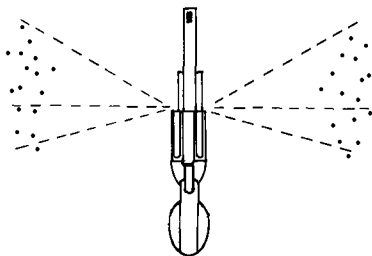


FIG. 9—Dispersal of discharge residues from cylinder blast.

products as cooking shortening. All these products perform the same functions, lubrication of the bore and sealing off the cylinder to prevent chain firing from stray sparks.) As one might expect, the presence or absence of the top strap of the weapon has a marked effect on the nature of residues generated. Tunnel tests of the two types of weapon confirmed the expected result with the top strap weapon producing a discrete pattern to each side while the Navy revolver produced a more or less continuous residue to the sides and top of the weapon.

The initial tests of single chamber firings produced considerably less particulate debris than was expected, however. It was discovered that the bulk of grease and propellant residues produced when firing a fully loaded percussion revolver originate, not from the chamber being discharged, but from the gases escaping the cylinder-barrel gap and blasting the lubricant and powder from adjacent cylinders out the sides of the weapon. This was confirmed by a series of paper tunnel tests using fully loaded weapons and comparing the results with the single chamber tests. Because this "side splatter" is so obvious, it was thought that it could help determine the sequence of shots fired in the present case.

One would expect the first shot discharged from a fully loaded cylinder to produce symmetric residues with roughly equal amounts scattered to both sides as in Fig. 10 (the amount of lubricant used varies with the preferences of the shooter and, as it is manually applied, will vary from chamber to chamber even in the same loading). As the cylinder rotates to its next firing position, however, the chamber first discharged becomes an empty space having no lubricant to contribute to the side splatter, whereas the third chamber provides a fresh

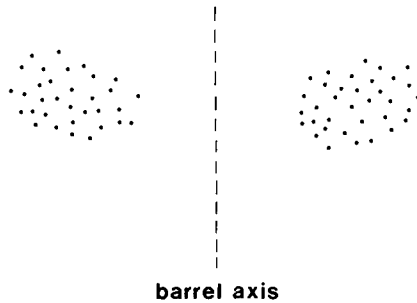


FIG. 10—Typical discharge pattern from fully loaded cylinder in revolver (top strap)—equal distribution to both sides.

supply. This would be expected to produce an asymmetrical pattern with a normal, or near normal, amount of side splatter out one side of the weapon and very much less out the opposite side, as in Fig. 11. In the case of these weapons, the cylinder rotates in a clockwise direction as viewed from the back and sequential firings would be expected to consistently produce normal or near normal residues out the left side of the weapon as compared to a reduced amount out the right side of the weapon. This supposition was confirmed upon paper tunnel tests of sequential firings. It was discovered that, no matter which weapon was used or what the nature of the loadings was, the residues were always discharged in a fairly narrow arc at roughly right angles to the barrel of the weapon. The location of these residues could then be used to reliably estimate the position of the cylinder of the weapon at the time at which it is discharged.

Distance Determination

Available percussion cap revolvers of similar caliber were test-fired at paper targets at various distances from 0.3 to 1.83 m (1 to 6 ft) per usual laboratory test procedures. It was discovered that the caliber of the weapon and the amount of powder used (such black powder weapons can be discharged with a powder load of between 15 and 30 grains of black powder depending upon the preference of the shooter) had surprisingly little effect on the density of powder distribution on the test targets or the diameter of the resulting patterns. It was noted that although the partially burned and unburned particulate residues were uniformly dispersed across the surface of the pattern, the residues of lubricant tended to be more focused in a central area of smaller overall diameter particularly at the shortest distances (less than 1.22 m [4 ft]). These patterns were then compared against the photographic and verbal documentation of the pathology report in both the area covered and the relative density of the particulate deposits to obtain an estimate of the distance for each.

Crime Scene Simulation

Investigators were fortunate that the crime scene was not disturbed for many months after the incident. It was then possible to attempt to simulate the production of residues visible on the walls of the scene using various weapons and testing under the same conditions as the original incident. Areas of the walls of the hallway were covered with panels of white butcher paper and weapons were discharged at various positions in the hallway towards a Detroit bullet trap located by the entry door where the decedent's body was found. It was found that the appearance of the residues originally on the walls could be duplicated to a large extent by

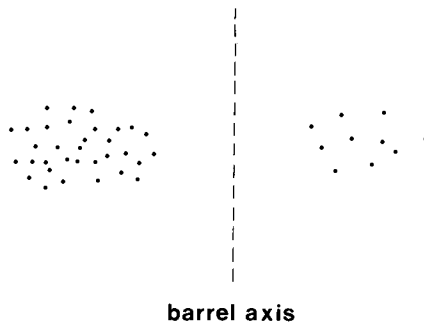


FIG. 11—Asymmetrical pattern from sequential firing of revolver cylinder (top strap).

controlling the position and sequence of firing of a percussion cap revolver of the type alleged to have been used.

Reconstruction

From a consideration of the residue patterns on the walls and ceiling of the scene, the appearance of residues on the face and torso of the decedent, firing characteristics of the percussion cap revolver in general, and the trajectories of the bullets striking the victim, it was possible to reconstruct a sequence of events and relative positions of decedent and assailant in which all the factors corresponded.

First, it was apparent because of the residues at Areas A and D in Fig. 1 that one shot had been fired from a position approximately 1.8 m (6 ft) inside the entrance door. These areas were centered approximately 1.3 m (51 in.) above the floor and were roughly equal in size and density of particulate deposits. This would be consistent with a weapon held at approximately 1.27 m (50 in.) above the floor and having been the first shot of a fully loaded cylinder. The residues on the face of the subject were similar to the diffuse deposits covering an area of moderate radius 127 mm [5 in.] on a test target that was 1.23 m (4 ft) from the muzzle of the weapon at the time of discharge. Based upon information from the autopsy report, it was estimated that if the decedent were standing fully upright at the time the bullet struck him in the forehead, it would have entered approximately 1.63 m (5 ft and 4 in.) above the floor. A slight downward tilt of the head would result in the trajectory of the bullet being consistent from the weapon 1.3 m (51 in.) above the floor in the middle of the hallway at a slight angle upward, with a portion of the projectile leaving the scalp and imbedding itself in the door of the bathroom at an approximate height of 1.65 m (5.5 ft) above the floor. This would place the victim standing just inside the entry door and in front of the bathroom door approximately 406.4 to 457.2 mm (16 to 18 in.) inside the hallway and at a distance of approximately 1.22 m (4 ft) from the muzzle of the weapon being held 1.83 m (6 ft) from the same doorway (see Fig. 12).

Residues at Areas B and C were centered approximately 762 mm (30 in.) above the floor with the deposits at Area B being considerably denser than the very diffuse random speckles located at Area C. The appearance of these deposits was consistent with a percussion cap revolver being discharged at a distance of approximately 3.2 m (11 ft) from the entry at a height of approximately 762 mm (30 in.). Because of the difference in intensity, these patterns also indicated that this was the second shot discharged from the revolver. If the decedent, at the time this shot was fired, were partially reclining with his back against the entry door and his leg extended roughly down the hallway, a shot from the indicated position

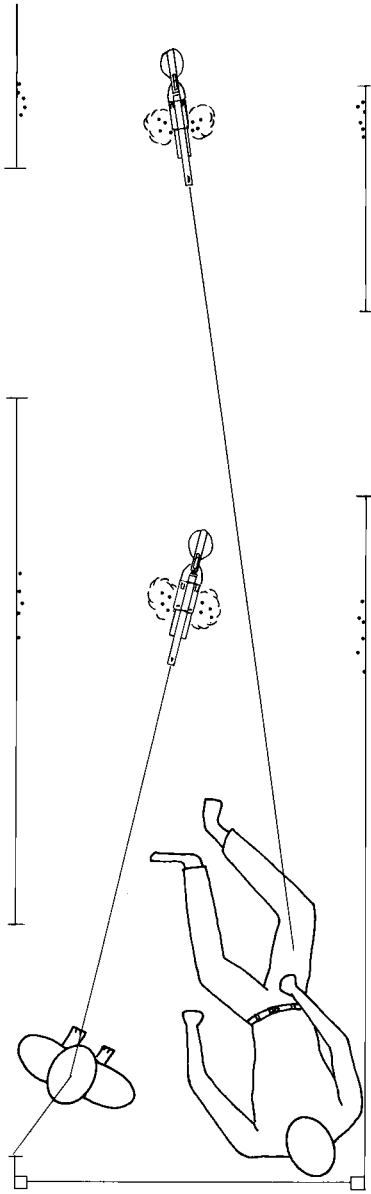


FIG. 12—Overhead view of reconstruction showing relative distances for two shots.

could result in an entry wound in the thigh and a trajectory upwards, across the abdomen as indicated in the pathology report. This reconstruction would require a muzzle-to-target distance of some 2.44 m (8 ft) which is consistent with the distance test results obtained.

A scenario of the relative positions and activities of the victim and assailant can now be theorized that agrees with the above reconstruction. The victim enters his house through the west entry door, begins to close the door behind him, and turns to face an assailant standing with the gun extended (at approximately shoulder height for an individual of average height). He is confronted, but before he has time to react, the gun is discharged, the bullet striking him in the forehead. Although he is badly injured he does not fall immediately and has time to touch his left hand to his forehead. Then, in an attempt to see his assailant, he reaches out and swipes for the light switch, leaving the smear of blood downwards and across the wall and switch. The assailant, apparently thinking he has fatally wounded his victim, is surprised that he still is moving and, as the victim collapses to the floor, the assailant backs up and, from a low crouch, fires a second shot from a greater distance away striking the now semi-reclining victim in the leg (see Fig. 13).

Conclusion

This case was prosecuted in early 1981 and testimony as to the firearm, ballistic, and trace evidence conclusions indicated here was offered in Superior Court. The accused was subsequently found guilty of second degree murder. It was apparent that because of the difficulties encountered in the reconstruction that several requirements are necessary to make the best of such reconstructions.

1. Careful photographs of all residues, whether on the structure or on the victim, are vital. These must include both closeup and overall photos of all such deposits before they are disturbed in any way. They must include a scale so that they can be adequately duplicated later.

2. Although the amounts of residues in this case were not sufficient for complete analysis, particularly those on the face of the decedent, it may be desirable in such cases to attempt gas chromatography or high pressure liquid chromatography of such waxes and oils to permit their specific identification in comparison with control samples from various sources. In such cases, adequate samples of the residues recovered using clean cotton swabs dampened with acetone or methanol would seem to be adequate for this purpose. Control samples for all surfaces sampled are a necessity, however.

3. All variables of weapon loading and operation must be examined whenever it is practical or indicated by the circumstances of the crime. Such variables as the amount of lubricant used will, of course, have an obvious effect on the nature and amount of residues produced by such a weapon. It appears that the powder load used does not have a great effect on distance determination tests but that is not to say this will not be the case in dealing with other percussion-type weapons.

It was possible to do a fairly complete reconstruction in which the activities and positions of both the victim and assailant could be reconstructed in a logical manner. The only unknown factor that could not be estimated is the motivation for the second shot having been fired at a greater distance from an apparent crouching position. It appeared from other circumstances of the case that the individual was not familiar with the weapon or its effects, having only discharged it on one previous occasion when first borrowing it from an acquaintance. In light of the considerable evidence left at the scene because of the use of percussion cap revolver, it is ironic to note that the accused apparently solicited the loan of a black powder weapon on the grounds that "it did not leave any evidence." He was apparently thinking that all black powder weapons are smooth bore and fire with cloth patches. Although it was unfortunate for him it was certainly fortunate for the authorities that he, in fact, chose the wrong weapon for his deadly mission.

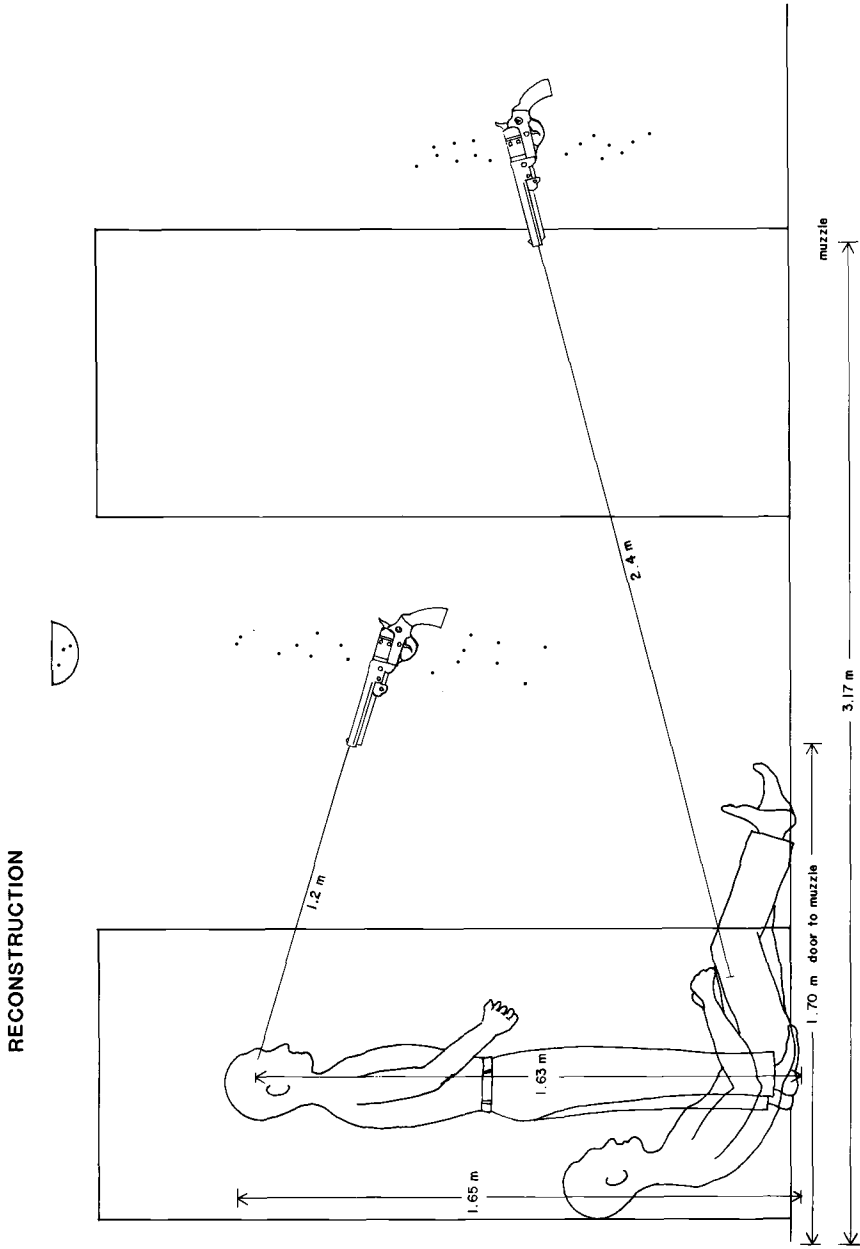


FIG. 13—Side view of reconstruction showing trajectories of two shots—the first from standing shoulder level, the second from a crouching position.

Acknowledgment

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