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POLICE SCIENCE



CALVIN GODDARD [Ed.]

SCIENTIFIC EVIDENCE IN CRIMINAL CASES*

I. FIREARMS IDENTIFICATION—"BALLISTICS"

FRED E. INBAU†

*"In this land of lies, an ounce of good circumstance
is worth many pounds of oral evidence"*¹

Judicial tribunals usually exercise considerable caution regarding the admissibility into evidence of expert testimony concerning some new phase of our ever increasing wealth of scientific knowledge. In certain instances this attitude has led courts of justice to reach apparently absurd results. The scientist occasionally reads with scorn the judicial denunciation of, or the refusal to consider, the application of a scientific principle or instrumentality. Yet the conscientious scientific investigator himself exhibits the same degree of caution, if not more, whenever there appears the announcement of some alleged discovery or invention.

The wisdom of this judicial conservatism is especially apparent in cases in which scientific testimony might be an important factor in the deprivation of human life or liberty. Nevertheless, there is considerable justification for some of the criticism directed at the

*Under this title will appear a series of articles prepared by the author while pursuing graduate study at the Northwestern University School of Law as a Raymond Fellow in Criminal Law.

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¹*Emporer v. Sahdeo*, 3 Nagpur L. Rep. 1 (1904).

courts for their apparently unintelligent treatment of certain cases in which scientific testimony is sought to be introduced.

Frequently the amateurish and unconvincing, and in some instances the deliberately dishonest presentation of "scientific" testimony is responsible for a court's refusal to admit it as evidence. Likewise, the super-cautiousness, or the innate inability of a court to appreciate the significance and reliability of certain forms of scientific evidence even when properly presented often accounts for the unduly deferred recognition of a scientific principle or its application.

Regardless of the justification for excluding evidence of a scientific nature, a court may assume either of two different attitudes—one open-minded and perhaps hopeful of the possibilities of the particular science in question; the other somewhat bigoted and scornfully expressive of the utter hopelessness of scientific aid concerning the problem before the court.² Throughout the numerous decisions upon the admissibility of scientific evidence there are many illustrations of both points of view.

In this series of articles an attempt is made to present the status of the criminal law concerning the admissibility of most of the numerous contemporary classes of scientific evidence, with the added effort of briefly explaining the various sciences themselves.

FIREARMS IDENTIFICATION—"BALLISTICS"

In ancient times, when it was customary for contracts to be written in duplicate on wooden tablets, there existed the practice of cutting identical notches on the borders of each tablet held by the contracting parties, so that the two documents could be matched and easily verified.³ In other words, the possibility of an extraneous correspondence of the set of notches appeared to be so remote that this was considered a reliable means of proving the authenticity of such instruments. And strange as it may seem, the science of firearms identification—commonly known as "ballistics"—is based upon the same principle.

It is rather difficult to realize the fact that discharged bullets and shells possess certain characteristic markings which unmistakably identify the weapon in which they were fired—this being determined by comparing the evidence bullet or shell with a test bullet or shell fired from a suspected weapon. Nevertheless, only a superficial un-

²For an excellent example of this see the two cases involving the "lie-detector" (293 Fed. 1013, 34 A. L. R. 145 (D. C., 1923); 246 N. W. 314 (Wis., 1933)), and compare the language there used with that found in the "truth-serum" case (*State v. Hudson*, 289 S. W. 920 (Mo., 1926)).

³See Annual Report, Smithsonian Institution (1912) 642.

derstanding of the process of gun manufacture is needed to appreciate the possibility of this phenomenon.⁴

One step in the manufacture of pistols and rifles is the boring of a hole through a cylindrical steel bar and reaming it, after which certain spiral grooves of uniform depth, width, and spacing are cut into the inner surface of the barrel, in order that a bullet fired through the barrel may have imparted to it rotational velocity, either to the right or left, which produces gyroscopic stability and consequently greater accuracy than it could otherwise have.⁵ The instrument used for this purpose is known as a "rifling cutter," a sharp tool whose arc-shaped edge, though flawless to the naked eye, when studied under a lens reveals minute saw-like teeth. And when this cutter is scraping out the grooves its serrated edge leaves small scratches on the inner surface of the barrel. Moreover, the same cutter will never leave identical scratches in any other barrel, or in two areas of the same barrel, for that matter, because of the fact that with every stroke the contour of this edge undergoes microscopic but none the less definite changes rendering it incapable of duplicating any given set of markings.⁶

Since the bullet is of a softer metal than the barrel of the gun through which it passes, it naturally receives certain impressions from the irregular surface over which it travels. These constitute the "tell-tale" characteristics which form the basis for the science of firearms identification by a comparison of fired bullets.

The mathematical probability of a duplication of the markings on a fatal bullet by those made upon another bullet fired from a different weapon is so remote as to permit an assumption that it is impossible. The mathematical calculation in this respect may be readily explained by considering the example used by Osborn regarding the possibility of two individuals having only eight distinctive physical characteristics exactly alike (such as a five-inch scar on the right forearm, a mole on the left temple one-half inch in diameter,

⁴For detailed explanation see Goddard, "Who Did the Shooting," *Popular Science Monthly*, Nov., 1927.

⁵The type, size, and number of these grooves vary in different makes of firearms. For instance, a Colt revolver will have six grooves inclined to the left (left twist), and a Smith and Wesson five inclined to the right (right twist), etc. Frequently these differences are extremely valuable in affording a clue as to the type of weapon used by a murderer. See in this connection, Wiard, "The Preliminary Identification of Fired Bullets," 3 *Am. J. Police Sci.* 14 (1932).

⁶Lieutenant-Colonel Calvin Goddard conducted experiments at a governmental arsenal and was able to distinguish between and identify bullets as coming from either of two rifle barrels made by the same rifling cutter one immediately after the other. See Goddard's testimony to this effect in *State v. Campbell*, 213 Iowa 677, 693, 239 N. W. 715, 723 (1931).

etc.). Applying Newcomb's formula—that the probability of concurrence of all the events is equal to the continued product of the probabilities of all the separate events—and even with an extremely small fraction representing how frequently each point may be found, Osborn concludes that the possibility of a duplication is one in thirty-eight trillion four billion, or something more than thirty thousand times the total population of the earth.⁷ The same principle holds true in the science of firearms identification. So, when a fatal bullet contains not eight but a hundred or more individual and characteristic markings, all matched by a bullet fired from the weapon of an accused individual, it is indeed safe to conclude that only a bullet fired from that particular weapon could duplicate these markings.

Identification may likewise be made from an examination of a discharged shell found at the scene of a crime, whether this be from a shotgun, machine gun, or pistol.⁸ The distinctive marks made upon the head of a shell by a firing pin, and by the breech face of the gun afford the evidence for a comparison of fatal and test shells.⁹

The firing pin of a weapon is that part of the mechanism which strikes the shell, causing the explosion. Because it is a machined down bit of steel, its surface presents characteristic scratches which are impressed upon the primers of the shells it discharges. The breech markings also found on the primers and shell heads arise when the empty shell is hurled violently back against the breech face (also a machined and filed surface) by the force of the recoil. Either of the two sets of impressions are distinctive of the particular weapon used and of no other, just as much so, and just as valuable from the standpoint of identification, as bullet markings.¹⁰

A specially designed instrument—the comparison microscope—is used for the purpose of firearms identification. It consists of two ordinary compound microscope tubes so arranged that images passing through both are brought together in one eye-piece midway between them. Under one of these tubes is placed the fatal bullet or

⁷See Osborn, *Questioned Documents* (2d ed. 1929) 226 et seq.

⁸For information concerning the precautions which should be taken by the police in order properly to preserve evidence of this nature for the purpose of subsequent identification, see Goddard, "Firearms as Evidence," 2 *Am. J. Police Sci.* 3 (1931).

⁹The extractor and ejector in automatic pistols, repeating rifles, and shotguns or machine guns will also leave distinctive sets of markings capable of use in identifying a fatal weapon. See explanation of this, and also photographs of such markings, in Goddard, "The Valentine Day Massacre: A Study in Ammunition Tracing," 1 *Am. J. Police Sci.* 60 (1930).

¹⁰See Mazger, Hess, and Hasslacher, "Determination of the Type of Pistol Employed from an Examination of Fired Bullets and Shells," 2 *Am. J. Police Sci.* 473 (1931); 3 *Ibid.* 124 (1932). Also *supra* note 9.

shell, and beneath the other the test bullet or shell, fired from the weapon belonging to, or in possession of, the accused. Then, by properly focusing the instrument and moving the bullets or shells into their correct positions, the comparison microscope will transmit the fusion of both fatal and test bullets or shells. If they were fired in the same weapon, there will be found a coincidence, in the case of the two bullets under scrutiny, not only of the major characteristics—the lands and grooves, which after all may only be indicative of the general type of weapon involved—but also of the numerous minute marks described above, which latter features afford unmistakable evidence as to the part, if any, played by the suspected weapon. Similarly, in the case where shells are examined, the presence or absence of a coincidence of the sets of impressions previously described will determine whether or not a particular weapon was used in the commission of the crime under investigation.

After fatal and test bullets or shells have been “matched” under the comparison microscope, enlarged photographs of them may be made for the purpose of illustrating to court and jury the similarities upon which the expert bases his opinion concerning the identity of the weapon used; and often these enlarged photographs assist the examiner in satisfying himself as to the correctness of his conclusions.

No one particular individual can be singled out as the founder of the science of firearms identification. The history of its development is somewhat similar in this respect to that of handwriting and typewriting identification—arising from casual observations and placed upon a scientific basis by several different workers.¹¹ The early

¹¹Dr. Albert Llewellyn Hall, of Fulton, N. Y., may be considered the father of firearms identification in the United States. See Hall, “The Missile and the Weapon,” *Buffalo Medical Journal* (June, 1900), and reprinted in *2 Am. J. Police Sci.* 311 (1931). A generation later Charles E. Waite made the next important contribution to this science. And his work began under most interesting circumstances. A charlatan, posing as an expert in firearms identification, had been instrumental in securing a verdict of guilty in a New York murder case decided about 1915. Mr. Waite, who was then attached to the Attorney General's Office, and detailed to an investigation of the case, was able to determine and to demonstrate conclusively to the Governor of New York that the witness who had testified at the trial had been in error as to the identity of the bullets. A pardon was granted. This innocent man's narrow escape from execution made such an impression upon Mr. Waite that he decided to undertake a study of “ballistics” in an effort to determine whether it might not be feasible to establish a scientific system which would of itself lessen the possibility of unscrupulous and incompetent testimony. He spent several years collecting data, and visiting factories where firearms were manufactured. He also made a tour of Europe for the purpose of securing further information upon the subject. Shortly after this he and Colonel Goddard formed the Bureau of Forensic Ballistics in New York City. Both of these men are primarily responsible for the present high degree of accuracy in firearms identification. See Goddard,

methods were rather crude. For instance, in France (and the same method is widely used there at the present time, despite the availability of the comparison microscope) fatal and test bullets were rolled on tinfoil, and the resulting impressions studied for the purpose of determining their similarity, if any.¹² The magnifying glass was used frequently, and unfortunately even in the United States at the present time so-called "experts" persist in using it. Not until 1925 was firearms identification placed upon a truly scientific basis. In that year, P. O. Gravelle, working in collaboration with C. E. Waite, Lieutenant-Colonel (then Major) Calvin Goddard, and J. H. Fisher, perfected the present comparison microscope—an adaptation of a smaller instrument devised by Osborn for the purpose of document examination. The utilization of the comparison microscope served to remove firearms identification from the realm of uncertain conjecture and to place it in the category of an exact science.¹³

Analysis of "Ballistics" Decisions

A Virginia case decided in 1879, *Dean v. Commonwealth*,¹⁴ is the first in which an appellate court approved of testimony regarding the similarity between fatal and test bullets—although weight, rather than any characteristic markings, constituted the basis for comparison. Moreover, it was held proper to introduce evidence to the effect that of all the guns in the community none were found which had the same bore or which could carry precisely the same ball. Two or three only, out of a large number examined, were found which were "nearly" of the same bore and which "might have" carried the same type ball as that removed from the body of the deceased. All of these were accounted for, however, with the exception of the defendant's gun.

Another interesting feature of this early case concerned the impressions upon a fence, presumably made when the murderer rested his rifle upon a rail in order to fire at the deceased who was working in his garden at the time. The evidence disclosed the fact that on top of the rail there was a distinct impression, and a "peculiar"

"Scientific Identification of Firearms and Bullets," 17 JOURNAL OF CRIMINAL LAW AND CRIMINOLOGY 254 (1926).

¹²Goddard, "Scientific Crime Detection Laboratories in Europe," 1 Am. J. Police Sci. 13, 21 (1930).

¹³It is interesting to note that in the field of firearms identification European countries have turned to the United States for assistance in this direction. Goddard, *op. cit. supra* note 12, at p. 21. Also see "Methods and Problems of Medical Education" 9th ser., Rockefeller Foundation, (1928) 53.

¹⁴32 Gratt (Va.) 912 (1879).

notch made on the edge of the rail. By actual experiment, "made by some of the witnesses," the defendant's gun when laid upon the same rail and drawn back left "a similar square impression and a similar notch, made by the small piece of iron which was fastened to the barrel near the muzzle."

In spite of the fact that all this evidence was of a more or less conjectural nature the Supreme Court of Virginia held it admissible to sustain a conviction of first degree murder.

The next criminal proceeding involving firearms identification arose in Connecticut in 1881. At the trial of that case, *State v. Smith*,¹⁵ the defendant requested the court to permit an expert to examine and make experiments with the evidence pistols to determine, if possible, from which one the fatal bullet was discharged. Just what experiments were contemplated the opinion does not state. It appeared, however, that they would "change the condition" of the weapons. And for that reason the trial court refused to permit any experimentation.¹⁶

Upon appeal the defendant alleged as error the trial court's ruling upon this point. The appellate court was of the opinion, however, that the matter lay wholly within the discretion of the trial judge, and that there was nothing erroneous in his refusal to permit the experimentation, since he considered it important that the pistols should go to the jury in their original condition,

This Connecticut decision is significant only for the reason that it apparently represents an early attempt at judicial recognition of what now has become the science of firearms identification. It will be noted that instead of "some of the witnesses" making experiments, as was true in the Virginia case, here an "expert" appeared for the first time. Moreover, it seems obvious that the "expert" was to attempt some sort of "identification" rather than indulge in a process of elimination.

In chronological sequence *People v. Mitchell*,¹⁷ a California case, was the next to involve the admissibility of firearms identification testimony. A gunsmith was permitted by the trial court to state his

¹⁵49 Conn. 376 (1881).

¹⁶See in this connection *State v. Hendel*, 4 Idaho, 88, 35 Pac. 836 (1894). In this case it was sought to determine whether or not a bullet found in the deceased's clothing contained substances which would indicate that it had passed through a human body. It was held proper for the trial court to refuse to permit a "microscopical and analytical examination to be made by competent expert of the substance or substances adhering to the bullet" for the reason that the co-defendant, to be tried subsequently, had the right to have the bullet remain in its present condition until the second trial.

¹⁷94 Cal. 550, 29 Pac. 11006 (1892).

opinion that a certain cartridge had never been in a pistol, because he saw no mark upon it. He was also allowed to compare the fatal bullet with one obtained from the pistol of another suspect and to state that they were not similar—a significant fact, because this reflected upon the defendant's guilt. The appellate court reversed the case, being of the opinion that the jury was as competent to pass upon this question as was the gunsmith.

The real application of firearms identification—that is, the matching of fatal and test bullets—received its initial approval by an appellate court in *Commonwealth v. Best*,¹⁸ a Massachusetts case decided in 1902. And it is interesting to note that the writer of the opinion sanctioning the use of this unique and novel form of circumstantial evidence was Mr. Justice Holmes, at the time when he served as Chief Justice of the Supreme Judicial Court of Massachusetts.

A test bullet was obtained from the defendant's rifle by "pushing" it through the barrel. Then photographs were taken of it and the fatal bullets for the purpose of comparison. The defendant excepted to the admission of the evidence pertaining to their similarity, mainly on the ground that "the conditions of the experiment did not correspond accurately with those at the date of the shooting, that the forces impelling the different bullets were different in kind, that the rifle barrel might be supposed to have rusted more in the little more than a fortnight that had intervened" To these arguments, Justice Holmes replied:

"We see no other way in which the jury could have learned so intelligently how that gun barrel would have marked a lead bullet fired through it, a question of much importance to the case. *Not only was it the best evidence attainable but the sources of error suggested were trifling.* The photographs avowedly were arranged to bring out the likeness in the marking of the different bullets and were objected to on this further ground. But the jury could correct them by inspection of the originals, if there were other aspects more favorable to the defense."¹⁹

Obviously the best technique had not been used in this case. Nor was there available the accurate scientific instruments now used by all careful investigators. Nevertheless, the witness must have presented some rather impressive evidence to incur the favorable opinion expressed by Justice Holmes.

The uncertain attitude of the early appellate courts concerning the admissibility of firearms identification evidence is illustrated quite

¹⁸180 Mass. 492, 62 N. E. 748 (1902).

¹⁹*Ibid.* pp. 495; 750. Italics added.

clearly in *People v. Weber*,²⁰ a California case decided in 1906. The trial court admitted the testimony of a witness to the effect that a fatal bullet had been fired from the defendant's gun, but then later on the court became doubtful "as to the soundness of its ruling" upon this point, and concluded to strike out the expert testimony. Firearms identification was considered to be "within the ordinary capacities of the average juror."

Upon appeal, the trial court's action in admitting the evidence in the first instance was alleged as error. But the appellate court was of the opinion that no injury could have resulted to the defendant because the evidence was subsequently treated as eliminated from the case.

State v. Clark,²¹ an Oregon case decided in 1921, appears to be the first one approving of identification by means of markings upon fatal and test shells. "A peculiar mark on the brass part of the primer" of the shell was used as the identifying characteristic.

Experiments and research have indicated that there need be no one "peculiar flaw" in order to make an identification. Every firing pin has many peculiar marks, as revealed under a microscope, and a shell discharged by a given firing pin will receive a set of impressions characteristic of that particular one and of no other.²² Consequently, in the foregoing case there probably existed a more accurate means of identification than the one employed.

Within the same year in which the previous decision was rendered, a conviction was obtained in *State v. Vuckovich*,²³ a Montana case, partly upon the evidence that "a peculiar crimp" on an empty shell found at the scene of a murder corresponded with a similar mark on shells fired from the defendant's pistol. Evidence was also introduced to show that "the firing marks made by the lands and grooves of the barrel of the pistol were the same" on both test and fatal bullets.²⁴ Thus this appellate decision represents an approval of both methods of identification—by the examination of *bullets and shells*.

Although Illinois was destined to contribute one of the most important and leading cases fully approving of the science of firearms identification, the Supreme Court of that state in one of its

²⁰149 Cal. 325, 86 Pac. 671 (1906).

²¹199 Ore. 629, 196 Pac. 360 (1921).

²²*Supra* note 10.

²³61 Mont. 480, 203 Pac. 491 (1921).

²⁴This case also held that the evidential value of the fatal bullet was not destroyed because of its secret removal from the body of the deceased.

earlier decisions, *People v. Berkman*,²⁵ failed to appreciate the significance or the possibilities of this new phase of circumstantial evidence. It even went so far as to label as "preposterous" the suggestion that distinctive markings were impressed upon bullets fired from different pistols of the same caliber and make.²⁶

Apparently the only expression by a Federal Court upon the subject is *Laney v. United States*,²⁷ decided in 1923. Expert testimony was held admissible as tending to establish the fact that the bullet extracted from the deceased's head had been fired from a pistol found in the defendant's possession. The discussion upon this point is very brief, perhaps for the reason that the other evidence seemed to establish conclusively the defendant's guilt.

The famous case of Sacco and Vanzetti did much to publicize the science of firearms identification. But because of the peculiar circumstances surrounding the case the general public naturally received an impression more unfavorable than favorable. Unfortunately, as is true in many such cases of national interest, there was a "conflict" of "expert" testimony. In spite of this fact, however, the trial judge stated in his memorandum that undoubtedly the irregularities in the barrels of pistols leave their impressions upon bullets, and that the determination of the similarity between fatal and test bullets ultimately depended upon what identifying marks the jurors saw when making the comparison.

Another interesting feature of *Commonwealth v. Sacco*²⁸ concerning firearms identification, and perhaps the most important in the interest of the science itself, was the report submitted to the Governor of Massachusetts by Colonel Goddard after he had examined the bullets under a comparison microscope—which was not used by the defense "experts" in the actual trial. In fact, this represents one of the earliest occasions upon which the instrument had been used in a criminal proceeding, although here Goddard was consulted only after conviction and while the petition for a reprieve was pending before the Governor. This report, accompanied by enlarged photographs of fatal and test bullets, substantiated the conclusions of the experts employed by the state—that the fatal bullet had been fired from Sacco's pistol.

To those adherents of the Sacco-Vanzetti cause it may be consoling to realize that the testimony concerning the identity of the fatal bullet went merely to prove that Sacco's weapon was used in the commission of the crime. There remained the remote possibility,

²⁵307 Ill. 492, 139 N. E. 91 (Apr. 18, 1923).

²⁶See *supra* note 6.

²⁷54 App. D. C. 56, 194 Fed. 412 (Dec. 3, 1923).

²⁸255 Mass. 369, 151 N. E. 839 (1926).

as is true in any case, that someone other than Sacco did the killing. In other words, an expert who testified that the fatal bullet came from a particular weapon is obviously not in a position to say who actually did the shooting. It remains for evidence of a different nature to place the weapon into the hands of the guilty individual. Nevertheless, it looks rather suspicious, to say the least, once the fact is established that the weapon in possession of an accused individual was the one used in the commission of a crime.

Beginning with *Jack v. Commonwealth*,²⁹ a Kentucky case decided in 1928, expert testimony concerning firearms identification began to receive a truly scientific analysis by appellate courts. The extended discussion devoted to the subject in this Kentucky opinion represents the first satisfactory treatment of this comparatively new phase of circumstantial evidence, even though there was a reversal of the trial court's conviction primarily upon the nature of the evidence itself.

The prosecution introduced two "expert witnesses," one a tax collector, the other a jailor for the community. Both testified that they were experienced in handling firearms and that they were familiar with the "catalogues issued by the various firearms companies." They used a magnifying glass in the examination of fatal and test bullets, and the trial court permitted them to testify as to the similarities. A conviction of murder resulted, and upon appeal the defendant alleged as error the admission of the testimony of these two witnesses.

In its consideration of the merits of the defendant's contention regarding this "expert testimony" the appellate court discussed in detail an article published by Colonel Goddard in 1927, in which the author described the process of firearms manufacture, the distinctive features which serve as the basis for identification, and the proper technique which should be used.³⁰ The court then concluded its opinion with the following language:

"It thus appears that this is a technical subject, and in order to give an expert opinion thereon a witness should have made a special study of the subject and have suitable instruments and equipment to make proper tests. In so saying we do not mean to accept or approve of any particular theory or test, but merely to illustrate the crudeness of an attempted test by parties without any special knowledge of ballistics and with only an ordinary magnifying glass. Certainly the witnesses in this case were not qualified to give such opinions and conclusions and the admission of such evidence was erroneous and prejudicial."³¹

The next case in chronological order, and also the first of a series of important decisions rendered in 1929, is that of *State v. Bocca-*

²⁹222 Ky. 546, 1 S. W. (2d) 961 (1928).

³⁰Popular Science Monthly, Nov., 1927.

³¹222 Ky. 546, 550, 1 S. W. (2d) 961, 964 (1928).

doro,³² decided by the New Jersey Court of Errors and Appeals. It involved a most interesting set of facts.

The defendant was suspected of having shot and killed the occupant of a home while in the act of committing burglary. In an effort to determine the defendant's whereabouts at the time of the murder, his common law wife was questioned as to her knowledge of the affair. She finally informed the investigators that on the particular night in question the defendant told her that he had fled from the scene of a burglary and had disposed of his pistol by throwing it away as he ran from the scene of the crime. The weapon was never located.

About a month prior to the murder, another home in the community had been burglarized, and among the articles stolen were some jewelry and a hammerless revolver. For some reason the owner became involved in the present investigation and he identified as his stolen property some jewelry in possession of the defendant's wife. The evidence indicated that this had been given her by the defendant. It was inferred, therefore, that if the defendant had stolen the jewelry he also was guilty of the theft of the revolver. Consequently, if there were any means of connecting that particular weapon with the murder in question, this would constitute a material factor in establishing his guilt.

It so happened—and herein is the strange feature of the case—that the owner of the stolen weapon had fired a bullet from it into the ground near his home, as part of a holiday celebration some year or two previous to the theft. It was suggested that this be retrieved for the purpose of comparison with the fatal missile, since there was no evidence weapon from which a test bullet could be obtained. Fortunately it was found. And an expert³³ was permitted to testify at the defendant's trial that this old bullet and the fatal bullet were fired from the same pistol. This evidence the appellate court considered sufficiently reliable to sustain a conviction of first degree murder.

The second of the 1929 decisions is *Galenis v. State*,³⁴ a Wisconsin case. The reported opinion is exceptionally brief, but the appellate court stated that as part of the evidence used to convict the defendant it was proper to produce his gun and prove by "competent evidence that it was the weapon from which the bullet found in the body of the victim was fired." No further information was

³²105 N. J. L. 352, 144 Atl. 612 (Feb. 4, 1929).

³³Colonel Goddard.

³⁴198 Wis. 313, 223 N. W. 790 (Mar. 5, 1929).

given by the court as to the means or methods used at the trial to connect the evidence bullet with the defendant's weapon.³⁵

In another 1929 decision, *People v. Beitzel*,³⁶ a California case, the propriety of firearms identification testimony seemed to be taken for granted, because upon appeal its admissibility was not alleged as error. Nevertheless, the appellate court remarked that "because of the peculiar 'spurs' on the nozzle of the gun and 'gauges' on the bullets found in the body of the deceased, a firearms expert testified that these bullets were fired from this particular gun."

Although in *Jack v. Commonwealth*³⁷ the Kentucky Court of Appeals reversed a conviction based upon incompetent firearms identification evidence—but at the same time indicating a somewhat favorable attitude concerning the subject—it remained for that same court, in the leading case of *Evans v. Commonwealth*,³⁸ to render the first exhaustive opinion treating firearms identification as a science while sanctioning its use for the purpose of establishing the guilt of an accused individual.

The appellate court prefaced its opinion with the remark that since the "storm center" of the appeal involved the admissibility of expert "ballistics" testimony and evidence (of Colonel Goddard) it would treat the case "with some degree of elaboration." The court then proceeded to quote at length the testimony of the witness, in which he explained in detail the process of gun manufacture, the manner in which a shell or a bullet receives its peculiar and distinctive characteristics, and the methods used in determining accurately whether or not a particular weapon has been used in the firing of fatal bullets or shells. Colonel Goddard's qualifications and his testimony were sufficiently persuasive for the court to state that his evidence did not fall within the class condemned in the previous Kentucky case. Consequently, after a review of the other pertinent decisions up to that date, the appellate court concluded that the evidence was properly admitted.

A most interesting feature of the case is the agreement reached by attorneys for both prosecution and defense regarding the "ballistics" testimony. The examination of the evidence bullets and shells was not made until the trial had begun. It was then understood that after Colonel Goddard had been sworn as an expert witness and had been given the fatal and test cartridges, he should retire from the court room, make his experiments, and then return to testify as to the

³⁵Colonel Goddard also testified in this case.

³⁶207 Cal. 73, 276 Pac. 1006 (Apr. 16, 1929).

³⁷*Supra* note 29.

³⁸230 Ky. 411, 19 S. W. (2d) 1091, 66 A. L. R. 360 (May 31, 1929). See note on this case by Professor Wigmore in 25 Ill. L. Rev. 692 (1931).

results—without telling either side of his opinion until he gave his testimony in open court. This is an approach to a highly desirable method for utilizing expert testimony in any field.³⁹

People v. Fiorita,⁴⁰ decided in 1930, is the second Illinois decision upon firearms identification. And it represents what might be termed the second stage in the progressive evolution toward judicial acceptance. The appellate court, in reversing a murder conviction against the defendant, included the admission of firearms identification testimony as one of the grounds for reversal—because of the incompetency of the witness rather than of the science itself.

“While the science of ballistics is now a well recognized science both in this country and abroad, testimony based upon it should be admitted with the greatest care. No witness should be permitted to testify regarding the identification of firearms and bullets by the use of this science unless the witness has clearly shown that he is qualified to give such testimony. . . . The experience and training of the witness . . . were far from sufficient to qualify him as an expert, and it was an abuse of discretion for the trial court to admit his testimony.”⁴¹

This represents a rather sensible attitude, in spite of the fact that the qualifications of the particular witness in this case probably would have been held sufficient in certain other courts. Where human life hangs in balance, however, an appellate court is perfectly justified in insisting upon very capable, and not merely ordinary, expert testimony.

The cautiousness exhibited by the Illinois court in the foregoing case of *People v. Fiorita* should be compared with the attitude assumed by an Ohio court in *Burchett v. State*,⁴² decided in the same year. In the latter case a banker, who had made the study of guns

³⁹There were other noteworthy features of this case. Colonel Goddard had been questioned at considerable length as to his qualifications, based upon education, profession, and experience. Objection was made to this. But the appellate court found nothing prejudicial in it. The case also illustrates the distinction made in Kentucky between *expert* and *skilled* witnesses. “Ordinarily a witness is said to testify as an expert when a state of facts, observed by someone else, is hypothetically submitted to the witness, and he is asked, in view of those facts, to state what his opinion is, whereas a man skilled in a particular business, who makes his own observations, and testifies to what he has observed and his conclusions therefrom, is regarded as a skilled witness.” Another point in the case involved the propriety of a statement made by the witness as to his being “convinced” that as a result of his experiments and observations the evidence bullet was fired through the defendant’s pistol. This was treated as an expression of the witness’ opinion and not as a statement of fact. Objection was also made to permitting the jury to look at the specimen bullet and shells through the comparison microscope, but this too was held proper.

⁴⁰339 Ill. 78, 170 N. E. 690 (Feb. 21, 1930).

⁴¹*Ibid.* pp. 89; 694.

⁴²35 Ohio App. 463, 172 N. E. 555 (May 9, 1930). See note on this case in 21 JOURNAL OF CRIMINAL LAW AND CRIMINOLOGY 607 (1931).

his *hobby*, was permitted to testify as to the similarity between fatal and test bullets, and this in spite of the fact that the witness himself insisted that he had no expert qualification. The appellate court was of the opinion, however that the witness was quite capable, and that his refusal to class himself as an expert "was a becoming expression of modesty."⁴³

In the Ohio case the court's leniency regarding the admissibility of firearms identification testimony may be accounted for by the fact that the other circumstances surrounding the case clearly indicated the defendant's guilt.⁴⁴

The third stage in the judicial attitude regarding firearms identification in Illinois is represented by the decision in *People v. Fisher*,⁴⁵ a case in which the Supreme Court of that state completely recognized the science as trustworthy and also indicated in an exhaustive opinion what expert qualifications would suffice to render such evidence admissible in a capital case.

Since the Illinois court had previously expressed its approval of the science in *People v. Fiorita*,⁴⁶ but had rejected such testimony merely upon the ground of insufficient qualifications of the witness, it was only natural to expect that in the instant case the primary consideration would center upon this phase of the subject. Consequently, the appellate court set forth in detail the qualifications of the expert in the *Fisher* case (Colonel Goddard). It then concluded that the trial court acted properly in admitting such testimony regarding the similarity in fatal and test bullets and shells.

In a subsequent case, *People v. Sullivan*,⁴⁷ the Supreme Court of Illinois again had before it the problem of firearms identification. An expert was unable to make a positive identification because of the distorted condition of the bullets, as occasionally happens, but the trial court permitted him to testify that the fatal bullets "might" have been fired from a pistol belonging to one of the defendants. And the appellate court approved of the testimony for the reason that it was significant," since other evidence indicated beyond doubt that one of the defendants was present and did fire a bullet of similar caliber at the time of the commission of the crime.

⁴³Even the most competent of honest experts are not often treated so kindly, especially during the proceedings in the trial court. For an article concerning the unnecessary difficulties encountered by "ballistics" experts, see Wiard, "The Cross-Examination of Expert Witnesses," 2 Am. J. Police Sci. 538 (1931).

⁴⁴For information concerning the frequency of similar occurrences in criminal cases generally see Baker, "Reversible Error in Homicide Cases," 23 JOURNAL OF CRIMINAL LAW AND CRIMINOLOGY 28 (1932).

⁴⁵340 Ill. 216, 172 N. E. 743 (June 20, 1930). See notes on this case in 29 Mich. L. Rev. 513 (1931), and in 4 So. Cal. L. Rev. 311 (1931).

⁴⁶*Supra* note 40.

⁴⁷345 Ill. 87, 177 N. E. 733 (June 18, 1931).

Matthews v. People,⁴⁸ a case decided in 1931 by the Supreme Court of Colorado, occasioned considerable adverse criticism directed at the science of firearms identification. At the trial of that case a gunsmith professed to be able to match fatal and test bullets by the use of a *magnifying glass*. His testimony was admitted by the trial court, but upon appeal the decision was reversed—and properly so. Almost any appellate court in the country would have arrived at the same conclusion. But there were two methods by which the Colorado court could have reached the same result. Unfortunately it chose the less desirable course. Each of the justices of the Supreme Court examined the bullets and they were unable to find any similarity. They decided, therefore, that the evidence was not only “weak and uncertain,” but in fact “no evidence” at all. In other words, this tribunal seems to have directed its criticism at the science itself, rather than at the faulty technique employed by the witness.

“A more desirable result would have been reached had the court chosen to override the discretion of the trial court and declare the witness not to have been properly qualified or competent as an expert. Such a course would have had the salutary effect of conducing to the more careful selection and preparation of this highly advantageous type of testimony in future cases without casting an unnecessary cloud upon the science of forensic ballistics.”⁴⁹

In this instance, whether or not similarities existed, the fact that the witness failed to use the proper equipment (i. e., comparison microscope), and to offer enlarged photographs of fatal and test bullets which would enable the average juror to recognize such similarities quite readily, is open to severe censure. This was the ground upon which the Colorado court should have reversed the case, rather than because of its own inability to detect the alleged similarities.

In *State v. Campbell*,⁵⁰ an Iowa case decided in 1931, there were two principal objections directed toward the admissibility of “ballistics” evidence. One concerned the qualifications of the witness, the other involved the question whether or not such evidence invaded the province of the jury.

The Iowa Supreme Court quoted from the trial court record the questions propounded of the expert witness, Colonel Goddard, concerning his qualifications, and his answers thereto were also noted. The appellate court found no merit in the objection regarding Goddard’s qualifications. Then considerable space was devoted in the

⁴⁸89 Colo. 421, 3 Pac. (2d) 409 (Sept. 21, 1931).

⁴⁹4 Rocky Mountain L. Rev. 219, 224 (1932). Also see note on this case in 23 JOURNAL OF CRIMINAL LAW AND CRIMINOLOGY 115 (1932).

⁵⁰213 Ia. 677, 239 N. W. 715 (Dec. 16, 1931).

court's opinion to the witness' testimony regarding the technique of and the scientific basis for firearms identification.

As to the contention regarding the invasion of the province of the jury by the witness, the court stated that the subject matter of the inquiry was so peculiarly within the range of scientific knowledge or special training and skill that "to exclude it would mark a denial of the only proof competent to establish the fact." And it was also held that propriety of the witness' testimony was not affected by the fact that he stated his opinion as a "conclusion" that the fatal and test bullets were fired from the defendant's pistol.

"The witness Goddard, as shown by his testimony, has made a special study of and is experienced in the subjects concerning which he was interrogated, and is shown to have had suitable instruments and equipment with which to make the test inquired about, and therefore, as such expert or skilled witness, his opinion upon the subject of inquiry is competent, a rejection of which would be a serious impairment of the rights of the State in the investigation of truth."⁵¹

A recent Kentucky case, *Crawford v. Commonwealth*,⁵² illustrates the limited extent to which firearms identification is useful in criminal proceedings. As was stated previously, in connection with the Sacco-Vanzetti case, an expert cannot say who actually fired the fatal bullet; his testimony terminates at the point where he states as his opinion whether or not a certain weapon fired the bullet in question. In the *Crawford* case experts testified that the fatal bullets came from a weapon alleged to have been used by the defendant. But there was no proof connecting the appellant in any way with its possession and use. Consequently, the "ballistics" evidence alone was not considered sufficient to establish the defendant's guilt.

The latest reported appellate court decision concerning the admissibility of firearms identification evidence is *Kent v. State*,⁵³ decided by the Supreme Court of Texas. There a witness was permitted to testify concerning the similarity in firing pin markings on test shells with those on shells found at the scene of a murder. His conclusion in this respect the appellate court considered merely as "an expression of opinion that the shells were alike" and the testimony was held properly admitted.⁵⁴

⁵¹*Ibid.* pp. 696; 724. See comment on this case: Baker, "The Campbell Case," 3 Am. J. Police Sci. 21 (1932).

⁵²242 Ky. 80, 45 S. W. (2d) 824 (Jan. 19, 1932).

⁵³50 S. W. (2d) 817 (Tex., May 4, 1932).

⁵⁴The witness in this case used a magnifying glass, but there seems to have been no serious objection made on that ground. Counsel for the defendant seemed more concerned over the fact that the test shells had been fired out of his presence, but the appellate court found nothing erroneous in that procedure.

As illustrated by the appellate court decisions previously discussed, it may now be considered as well settled that firearms identification evidence is admissible as a circumstance tending to establish the guilt of an accused individual. The superior courts of Illinois, Iowa, Kentucky, Montana, New Jersey, Ohio, Oregon, Texas, Wisconsin—and a Federal Circuit Court of Appeals—have definitely held such evidence admissible. The courts of a few other jurisdictions (e. g., California,⁵⁵ Connecticut,⁵⁶ Oklahoma,⁵⁷ Virginia⁵⁸) have also indicated their approval of its use in criminal cases.⁵⁹ Moreover, it must be remembered that “ballistics” testimony is not confined to these jurisdictions. Hundreds of trial cases in other states are never appealed upon that ground, presumably for the reason that the question as to its admissibility is no longer considered an open one.⁶⁰

The testimony of firearms experts has not been restricted to the type of evidence considered in the foregoing cases—that is, similarity in markings on fatal and test bullets or shells in order to determine the identity of a particular weapon. Numerous other situations arise in which it becomes important for a jury to ascertain a certain fact capable of determination only by evaluating the opinion of, or by considering the results of experiments made by, an expert on the subject.

Expert testimony regarding the distance at which a shot was fired is perhaps the most generally used testimony of this latter sort. In homicide cases in which a plea of self-defense is set up, or in which the defendant contends that death resulted from suicide, the question of distance is of considerable importance. And it is often capable of accurate determination. In instances of pistol or rifle wounds the extent of powder burning upon the victim's body is the criterion. For shotgun wounds the extent of the scattering of the shot is the significant feature.

By firing at various distances upon a piece of cloth similar to that worn by the deceased, or upon a large sheet of ordinary white

⁵⁵See *People v. Weber*, *supra* note 20; *People v. Beitzel*, *supra* note 36.

⁵⁶*State v. Smith*, *supra* note 15.

⁵⁷*Collins v. State*, 150 Okla. Cr. Rep. 96, 175 Pac. 124 (1918).

⁵⁸*Dean v. Commonwealth*, *supra* note 14.

⁵⁹It might be inferred, from a consideration of similar technical evidence approved by other appellate courts, that many other jurisdictions would doubtless sanction the use of “ballistics” testimony. For instance, the Supreme Court of Washington has affirmed a conviction based almost solely upon scientific evidence to the effect that the knife found in possession of an accused person was the knife that cut the twigs and three branches of a blind in which a young girl was brutally assaulted. *State v. Clark*, 156 Wash. 543, 287 Pac. 18 (1930). It is apparent, therefore, that a court admitting such delicate evidence as this would have little difficulty in approving of “ballistics” evidence.

⁶⁰For other articles containing a survey of the cases decided up to 1931, and also expressing the same conclusion herein stated, see Serhant, “The Admissibility of Ballistics in Evidence,” 2 Am. J. Police Sci. 202 (1931); Buxton, “The Science of Ballistics: Judicial Applications,” 2 *ibid.* 211.

paper, or upon a piece of fresh hog's skin, a comparison may be made of the powder burning thus obtained with that upon the deceased's clothing, or upon his body, as the case may be. When the area covered by the evidence burns is approximately the same as that obtained at a known distance in the experimental shooting, then a fairly accurate estimate may be made of the distance at which the fatal shooting occurred. The same method is used in determining shotgun distances, but reliance is placed upon the extent of shot dispersion—the "pattern"—rather than upon powder burning, unless the firing occurred at a relatively close range, in which instance both criteria will be employed.

Many appellate courts have approved of the admissibility of testimony based upon such experimentation.⁶¹ The few rejecting evidence of this nature rely upon the usual excuse that the experiments were not conducted under "circumstances and conditions substantially the same as those existing at the time of the shooting."⁶²

Expert testimony has been held admissible to prove similarity in the size,⁶³ and weight⁶⁴ of fatal and test bullets or

⁶¹*Powder burns: Sullivan v. Commonwealth*, 93 Pa. St. 284 (1880); *People v. Clark*, 84 Cal. 573, 34 Pac. 313 (1890); *State v. Ashell*, 57 Kan. 398, 46 Pac. 770 (1896); *Thraley v. State*, 153 Ind. 375, 55 N. E. 95 (1899); *State v. Melvern*, 32 Wash. 7, 72 Pac. 489 (1903); *Little v. State*, 72 Neb. 228, 100 N. W. 316 (1904); *State v. Voorhies*, 115 La. 200, 38 So. 964 (1905); *Pollock v. State*, 136 Wis. 136, 116 N. W. 851 (1908); *Hughes v. State*, 126 Tenn. 40, 148 S. W. 543, Ann. Cas. 1913D, 1262 (1912); *People v. Ferdinand*, 194 Cal. 555, 229 Pac. 341 (1924); *Drake v. Commonwealth*, 214 Ky. 147, 282 S. W. 1066 (1926). Cf. *Brownell v. People*, 38 Mich. 732 (1878). ("It appears to us that the testimony of one called as an expert upon the effect of a pistol shot upon the clothing when fired at a certain distance, was based on too small an evidence. A single pistol shot through his own clothing, without any proof of comparative amounts or kinds of loading, and without ever seeing further experiments at greater or less distances or at the same distance, with pistols of the same or different make or caliber, is too small a foundation for generalizing."); *Morton v. State*, 43 Tex. Cr. Rep. 533, 71 S. W. 281 (1902) (Error to introduce testimony to show distance, where experiments were made by firing at pasteboard target, since the pasteboard was not similar to skin of a human being.); *Reggan v. State*, 84 Tex. Cr. Rep. 468, 208 S. W. 523 (1919) (White paper held not sufficiently similar to skin to permit testimony where such paper was used in experiment.). Also see *Timothy v. State*, 130 Ala. 68, 30 So. 339 (1901), where it was held improper to permit a witness to read from books on medical jurisprudence to prove his point as to distance.

Gunshot pattern: State v. Jones, 41 Kan. 309, 21 Pac. 265 (1888) ("This is a question of science, to be ascertained by study and experience, and does not come within the common knowledge of man."); *Bearden v. State*, 44 Tex. Cr. Rep. 578, 72 S. W. 17 (1903); *Phillips v. State*, 170 Ala. 5, 54 So. 111 (1910). Cf. *Hisler v. State*, 52 Fla. 30, 42 So. 692 (1906) (The same or a similar gun must be used, as well as the same powder, shot, etc., or else the testimony is inadmissible.); *People v. Wagner*, 29 Cal. App. 363, 155 Pac. 649 (1916) (Shooting at blocks of wood supposed to represent deceased, in order to show pattern, not considered as made under circumstances and conditions substantially similar to those existing when the killing occurred.).

⁶²*Supra* note 61, cases cited Cf.

⁶³*Moughan v. State*, 57 Ga. 102 (1876); *Collins v. State*, 150 Okla. Cr. App. 96, 175 Pac. 124 (1918).

⁶⁴*People v. Sullivan*, 129 Cal. 557, 62 Pac. 101 (1900).

shot;⁶⁵ to prove that a fatal bullet was fired from a weapon of certain caliber and make,⁶⁶ to prove that wound was made not by a shotgun but by a rifle loaded with small shot;⁶⁷ to prove that the character and size of a bullet wound indicated the caliber of pistol used;⁶⁸ to prove that a suspected weapon was recently fired—a significant fact to establish when an accused individual alleges that his arm had not even been fired about the time of the fatal shooting.⁶⁹ It also has been held permissible to introduce expert testimony regarding the direction from which a fatal shot had been fired, as indicated by the nature and position of the wound.⁷⁰

⁶⁵At first blush it may appear that the admissibility of such evidence is not to be questioned in those jurisdictions which admit "ballistics" testimony proper, for the reason that the latter class is of a more complicated and delicate nature than the former. And yet, because "size" and "weight" testimony only serves to eliminate rather than to identify, it is conceivable that courts admitting "ballistics" testimony might exclude the other as immaterial. Nevertheless, the reason for admitting this evidence is a good one, and is clearly expressed in *People v. Sullivan*, *supra* note 64: "Notwithstanding the slight difference in weight in the bullet, under the circumstances it cannot be said that the jury were not justified in finding that it was the one shot from the gun borrowed by the defendant, nor can it be said that the chain of circumstantial evidence was not sufficient to support the verdict of the jury."

This sort of evidence is somewhat similar to that found in *State v. Sprouse*, 177 S. W. 338 (Mo., 1915), in which a witness was permitted to testify that the hole in the skull of the deceased corresponded in size and shape with the projection on the "knuckles" in the defendant's possession.

⁶⁶*State v. Laudans*, 74 Conn. 638, 51 Atl. 860 (1902); *State v. Casey*, 108 Ore. 386, 213 Pac. 771, 217 Pac. 632 (1923). Since the defendant in the latter case possessed a weapon of the "same caliber and make," unless the fatal bullet was completely distorted (and then it would not have been possible to determine caliber and make of weapon firing it) it should have been possible for the witness to state definitely whether or not the bullet had been fired from the particular gun in question. With the aid of proper equipment he could have been more certain, and by using enlarged photographs he could have been more convincing. Nevertheless, a conviction was obtained partly upon the "expert testimony" as given, and the appellate court affirmed the case on the theory that the weight to be attached to the testimony was exclusively for the jury. In *People v. Dye*, 6 Pac. (2d) 313 (Cal., Dec. 17, 1931), a case also admitting testimony regarding caliber and make, the situation was somewhat different. The defendant had disposed of his gun, and therefore evidence that the fatal bullet came from a pistol of caliber and make similar to the one he was known to have owned was very important as a circumstance indicating his guilt.

⁶⁷*Franklin v. Commonwealth*, 105 Ky. 237, 48 S. W. 986 (1899).

⁶⁸*Burton v. State*, 194 Ala. 2, 69 So. 913 (1915). See also *Landry v. State*, 35 S. W. (2d) 453 (Tex., 1931).

⁶⁹*Meyers v. State*, 14 Tex. Cr. App. 35 (1883); *Pemberton v. State*, 54 Tex. Cr. App. 464, 117 S. W. 837 (1909); *Hughes v. State*, 135 So. 310 (1931). See *State v. Davis*, 55 S. C. 339, 33 S. W. 449 (1899), in which it was held proper for the prosecution to introduce expert testimony to the effect that a gun and empty shells found near the body of deceased did not present the appearance of having been fired recently. In *Holder v. State*, 81 Tex. Cr. Rep. 194, 194 S. W. 162 (1917), an expert was permitted to testify that only one shot had been fired from the deceased's pistol.

⁷⁰*Lassiter v. State*, 137 Ark. 273, 208 S. W. 21 (1919); *Fisher v. State*, 100 Tex. Cr. Rep. 205, 272 S. W. 465 (1925); *State v. Sharp*, 174 La. 860, 141 So. 859 (1932). In *State v. Buralli*, 27 Nev. 41, 71 Pac. 532 (1903), expert testimony was admitted to show the relative position of the parties at the time of the fatal shooting—as indicated by the course of the bullet through the body.