New Zealand Police

2014

CREWE HOMICIDE INVESTIGATION REVIEW

Ballistics Reports

APPENDIX 8

Appendix 8

Ballistic Reports

1. **George PRICE, Principal Scientific Officer, Head of Ballistics Section, Home Office Forensic Science Laboratory, United Kingdom (1972)**

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6. **Report on the examination of photographs of bullets and bullet comparisons relating to the Crewe homicides, by Kevan WALSH, ESR Scientist, Auckland, New Zealand (2014)**

7. **.22 Rifle Collection Phase Testing Schedule**

Appendix 8

(1)

George PRICE, Principal Scientific Officer, Head of Ballistics Section, Home Office Forensic Science Laboratory, United Kingdom (1972)

H9

Home Office
FORENSIC SCIENCE LABORATORY
(EAST MIDLAND AREA)
Shakespeare Street, NOTTINGHAM
Telephone: Nottingham ~~41061~~ 45072

Please address any reply to
THE DIRECTOR
and not to any individual
quoting: M/22/72
Your reference:

REPORT on the examination of material received from Mr R G Mitchell of the New Zealand High Commission Office, London, on 6 July 1972, labelled as follows:-

(a) Exhibit 317 Rifle

(b) Exhibit 289 (2 glass tubes containing bullet fragments 'from David Harvey Crewe')

(c) Exhibit 234 (2 tubes containing bullet fragments 'from Jeannotte Lenore Crewe')

(d) Exhibit 257 fragment of bullet ('from Jeannette Lenore Crewe')

(e) Exhibit 350 (Cartridge case)

(f) Bullet test fired from rifle 86942 on 18 August 1970

(g) Exhibit C1 (cartridge cases, test fired)

The above material was received in a sealed wooden case, the seals of which were intact.

The rifle (exhibit 317) is a .22" pump action, repeating rifle, No 86942, Browning's patent, made by Fabrique National D'Armes De Guerre, Belgium. The bore of the rifle is rifled with six grooves and lands having a right hand (clockwise) twist.

Exhibit 289 comprises nine fragments of lead, one of which is identifiable as the badly damaged base portion of a .22" bullet. The rifling reproduced on this shows only one groove and a part of a land which lend themselves to microscopical examination and comparison, showing limited bore characteristics only. Because of this I have been unable to establish whether or not this bullet was fired in the rifle exhibit 317. The groove shown on this bullet is consistent in width with the grooves reproduced on the bullet (f) and bullets I have fired in the rifle (exhibit 317).

Exhibit 234 comprises eight fragments of lead, one of which is the damaged bottom half of a .22" bullet, displaying rifling of the same type as that of the rifle

/(exhibit 317).

(exhibit 317). I have microscopically examined this bullet. Although I have been unable to establish conclusively whether or not it was fired in the rifle Exhibit 317 the limited individual bore characteristics it shows indicate that it could well have been fired in this rifle.

Exhibit 257 consists of three lead fragments which show no identifiable bore characteristics.

I have microscopically examined the .22" cartridge case (exhibit 350) and as a result I am satisfied that it was fired in the rifle (exhibit 317). There is no means whereby I can establish the period of time that this cartridge case was present at the scene of crime. It is tarnished and the inside shows deposits of verdigris associated with powder residues. I detected no traces of soil on the case. It is not possible to associate the cartridge case with any of the bullet fragments, moreover I would not normally expect to be able to do this.

The total weight of the fragments (exhibit 289) is such that they could be parts of one .22" bullet and the combined total weights of the fragments (exhibit 234) and (exhibit 217) indicate that they originated from one .22" bullet.

NOTE ON THE IDENTIFICATION OF FIRED BULLETS

Usually a firearm used in crime, the condition of which has not materially altered, produces test bullets, characteristic of the bore, which positively match the crime bullets it fired. Thus detailed agreement of such characteristics enables the expert to link the crime bullet with the weapon in which the test bullets were fired. Bore characteristics on bullets comprise (a) the rifling (ie grooves and lands), which may be peculiar to a make of weapon, characterised by the number and direction of twist of the grooves, and width of the grooves and lands, and the pitch of the rifling; (b) markings individually characteristic of a bore arising from accidental imperfections of that bore. The chances of correspondence of individual characteristics on bullets fired in different bores are so remote as to amount to a practical impossibility, and no such correspondence has ever been recorded. However, when a crime bullet has suffered damage, thus considerably reducing the surface area

/available

available for comparison, in addition to possible distortion of characteristics, identification becomes more difficult and consequently less certain.

It is noted that of 64 .22" rifles examined in this connection in New Zealand only two (including the exhibit 317) showed rifling of the type shown on the exhibit bullets.

The following is a list of .22" weapons, of different makes and types which are included in the firearm collection here, which will fire ammunition of the same type as the exhibit bullets and cartridge case.

TYPE OF WEAPON	TOTAL	THOSE WITH RIFLING 6.R.	THOSE WITH GROOVE AND LAND WIDTH AS THE EXHIBIT BULLETS
RIFLES	268	103	4 (2 of these are Browning's, one being the same as Exhibit 317)
REVOLVERS	211	44	4
S.L. PISTOLS	84	57	3 (one of which is a Browning)
S.SHOT PISTOLS	125	42	4
TOTALS	688	246	15

On Thursday 27 July 1972 Mr R S Murray, of Messrs Churchill's Gunmakers, London, visited this laboratory, when I produced the exhibits in my possession, for his attention. My examination of the exhibits had at this time been completed. Mr Murray made notes of the techniques and equipment used by me. He did not carry out any detailed examination.

G. Price

G PRICE

Principal Scientific Officer
Head of Ballistics Section

2 August 1972

Appendix 8

(2)

Randolph MURRAY, Director of Churchill Atkin Grant & Lang Limited, England (1972)

Exhibit

REPORT BY R.S.MURRAY IN THE MATTER OF A PETITION BY ARTHUR ALLAN THOMAS.

I am Randolph Stuart Murray, over 21 years of age and reside at 5 Rosebank, Coast Road, West Mersea in the county of Essex. England. I am a Director of Churchill Atkin Grant & Lang Limited who are Gunmakers in London England, I have twice been Master of the Worshipful Company of Gunmakers in the City of London, am an Assistant to the Court of the said Company and a member of the Proof Committee. For over twenty five years I was a Council Member of the Guntrades Association of Great Britain and served as a Chairman of the said Association.

On the 27th July 1972 by arrangement with Mr.Byron O'Keefe I visited the Home Office Forensic Laboratory at Nottingham and met there the Director, Dr.Holden and the Ballistics Expert Mr.George Price.

I have known Mr.George Price for many years, probably eighteen, and hold him in the highest regard both for his complete integrity and his very wide knowledge of the science of identification of arms and ammunition. There is no doubt whatsoever that the report which Mr.Price will give is truly and honestly compiled from the exhibits in his possession.

I inspected a .22 F.N.Browning Pump action or trombone action rifle of conventional design but from outside appearances it was not in very good condition, I was informed that it was the weapon involved in the shooting incident for which Arthur Allan Thomas was convicted but I did not carry out a detailed inspection. The number of the rifle is 86942.

I was shewn a fired cartridge case of .22 Long Rifle type Exhibit No.C 50 which did not shew any signs of serious staining or discolouration but there were signs of verdigris on the inside of the case. The case had first been examined on a Nikon microscope of recent type fitted with a zoom lens and it was then examined in comparison with another cartridge case fired from rifle

number 86942 under a deVere Comparison Projection microscope and the clear agreement of striker and breech block indentations was apparent. Both cartridge cases were of Imperial Chemical Industries manufacture and there is no doubt that the cartridge case exhibited at the trial is one which was fired from the above rifle no.86942. The deVere Microscope in use at the Laboratory at Nottingham is a very good instrument and although fairly old is in excellent condition and has had new lens assemblies added from time to time.

I was shewn Exhibit No.234 which consisted of eight fragments of a bullet, said to be from the same bullet, and the largest of these pieces is the base of a bullet with the figure '8' quite clearly seen on the bottom of the bullet. The fragment was large enough to determine that it had characteristics of rifling marks which indicate that it could have been shot from rifle No.86942, but certainly from a rifle having six grooves and lands corresponding in size and twistto the type of rifling used in the manufacture of rifles by the Fabrique Nationale Herstal S.A. who were the manufacturers of the rifle No.86942. The size of the fragments prevents positive conclusion but the combined weight of the pieces did not exceed the weight of a normal .22 Long Rifle bullet.

I was shewn Exhibit No.289 which consisted of nine fragments of a bullet, said to be from the same bullet which altogether weighed 29.5grains and the largest of these pieces had been examined under

a microscope but it had only one groove and one land mark. Although it could not positively be identifiedas having come from any precise weapon; the marks shew that it had come from a rifle having the characteristics of a weapon similar to those made by Fabrique Nationale Herstal S.A. The weight of the fragments is together less than the weight of a normal .22 Long Rifle bullet.

R.S.Murray.

1st August 1972.

Appendix 8

(3)

Peter PRESCOTT, Principal Scientific Officer, Head of Ballistics Section, Home Office Forensic Science Laboratory, United Kingdom (1980)

HOL[illegible]

LAB.
REF. K/23/72

STATEMENT OF WITNESS

(Criminal Justice Act, 1967, ss. 2, 9.; M.C. Rules 1968 r.58)

STATEMENT OF PETER SHEPSTONE PRESCOTT

Age of witness (if over 21 enter "over 21") OVER 21

Occupation of witness FORENSIC SCIENTIST

Home Office Forensic Science Laboratory, Shakespeare Street, NOTTINGHAM NG1 4FR

This statement (consisting of 2 page(s) each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it anything which I know to be false or do not believe to be true.

Dated the 30th day of September 1980

Signature P.S. Prescott.

I am a Principal Scientific Officer in charge of the Firearms Department of the Home Office Forensic Science Service.

I have been a Forensic Scientist for 32 years and in that capacity I have been examining firearms for approximately 30 years.

I have read a copy of a report dated August 2 1972 made by Mr.G.Price, formerly of this laboratory in which reference is made to the examination of marks on part of a bullet Exhibit 234 and on marks on a bullet said to have been test fired on August 18, 1970 in a rifle (Serial Number 86942) Exhibit Number 317.

I have examined notes and other evidence recorded as being connected with the rifle Exhibit Number 317, bullet fragments Exhibit Number 234, bullet fragments Exhibit Number 289, bullet fragments Exhibit Number 257, cartridge cases Exhibit Number 350, a cartridge case (C1) stated to have been fired in the rifle (317) and the bullet said to have been test fired in the rifle (317) on August 18 1970. The test fired bullet is referred t in these notes by the letter (F).

P.S. Prescott.

STATEMENT OF WITNESS—Continuation Sheet

LAB. REF. M/22/72

of PETER SHEPSTONE PRESCOTT

From my examination of the notes I am satisfied that Mr. Price compared the part of the bullet (234) with the test bullet (F). He also test fired the rifle (317) and compared the test bullets obtained with the bullet (234). His examination of the bullet (234) showed that only five grooves and lands were visible on it whilst 6 grooves and lands were visible on the test bullet (F). The absence of one or more grooves, together with any markings there may be present in them, is not unusual with unjacketed bullets that have suffered impact damage.

The evidence available to me shows that there is agreement between rifling marks on the bullet (234) and rifling marks on the bullet (F), and rifling marks on test bullets fired by Mr. Price in the rifle (317). This agreement occurs on one land and two grooves of the bullets: because of the degree of agreement I have formed the opinion that it is highly probable that the rifle (317) fired the bullet (234).

I found nothing in the notes and records to show that Mr. Price had found evidence of scoring on one of the lands in the barrel of the rifle (317). I have examined all the bullets test fired by Mr. Price in the (317) and I found no evidence of scoring on any of them. The absence of a score mark on the test fired bullets does not affect my opinion expressed above.

P.S. Prescott

P.S.PRESCOTT
Principal Scientific Officer.

Signature

Appendix 8

(4)

Report of examinations conducted on 14 June 2007 of Com 40

Exhibits by Kevan WALSH,

ESR Scientist, Auckland, New Zealand

ESR

PET06175

ESR Reference: **PET06175**
Enquiries to: [redacted]

22 June 2007

The Officer in Charge
Wellington Central Police Station
PO Box 693
WELLINGTON

Attention: John Walker

Case name: **Crewe Homicides**

Attached is a report prepared by Mr Kevan Walsh relating to his examination of Comm 40 exhibits from Archives New Zealand on 14 June 2007.

Sally Coulson
Authorising Scientist
Physical Evidence

Kevan Walsh
Case Manager
Physical Evidence

Institute of Environmental Science & Research Limited
Mt Albert Science Centre
Hampstead Road, Mt Albert, Private Bag 92-021, Auckland, New Zealand
Telephone: (09) 815-3670, Facsimile: (09) 849-6046

Report of examinations conducted by Kevan Walsh on 14 June 2007 of Com 40 Exhibits

On 14 June 2007 at the Police Documents Section of the Wellington Central Police Station, Mr Kevan Walsh examined various items relating to "Com 40" from Archives New Zealand. Also present were Mr Des Thomas, Dr Nicholas Powell and Inspector John Walker.

One purpose of the examination of items was to see if it was possible to clarify the provenance of exhibit 209, which is described as being a bullet test fired in the Eyre rifle. At the Royal Commission in 1980 it was determined that the Eyre rifle had rifling characteristics of five lands and grooves with a right-hand twist (5R). In 2006 an examination by Mr Kevan Walsh and Dr Nicholas Powell determined that exhibit 209 was a bullet fired in a rifle with six lands and grooves with a right-hand twist (6R). If the Royal Commission finding relating to the Eyre rifle was correct, then exhibit 209 could not have been fired in the Eyre rifle. A possibility to be explored is that exhibit 209 contained a bullet fired in the Thomas rifle, which is accepted to have 6R rifling.

Within the box of "Com 40" exhibits there were assorted items, including one item that appeared to have no relation to the Crewe investigation (labelled SEP713).

All items were inspected to determine if they had ammunition-related items in them. Only those items that contained ammunition-related items were examined. In the appendix is a list of items examined with a brief description.

Only three items contained fired bullets. These were exhibits 50, 201 and 209.

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Exhibit 50 contained three mushroomed, fired lead bullets (from reconstruction 13 October 1970). From the firing pin impressions and the width of the lands and grooves of the bullets, it could be concluded that these items had not been fired in the Thomas rifle. The firing pin impression was semi-circular. The width of the groove impressions was at least twice as wide as the width of the land impressions. The rifling of these three bullets was clearly different to the fired bullets of exhibits 201 and 209. For exhibits 201 and 209, the width of the groove impressions was slightly less than the width of the land impressions.

Exhibit 201 contained two fired Pattern 18 bullets (with "3" and "4" scratched onto their bases, respectively) and one fired Pattern 8D (or Palma) bullet (with "RS 22/9/80" scratched onto the base). These were described as having been fired in the Thomas rifle (serial number 86942).

Exhibit 209 contained one fired Pattern 8 bullet and was described as having been fired in the Remington rifle [of Mr Eyre]. There was no identification marking scratched onto its base.

Comparison of test-fired bullets 3 and 4 of exhibit 201

I compared these two bullets using the "Projectina" instrument of the Police Documents Section.

These two bullets had very clear fine striae within the land impressions of the rifling marks. The land impressions are the grooves on the bullets created by the lands of the bore of the barrel.

I was able to compare these two bullets side by side and I observed within the rifling marks a significant correspondence of microscopic detail between the two bullets. In my opinion these two bullets were fired in the same firearm.

For subsequent comparisons to the other bullet of exhibit 201 and the bullet of exhibit 209, I used the bullet labelled "3". I have assumed that this bullet has been fired in the Thomas rifle.

Comparison of the test-fired "RS 22/9/80" bullet of exhibit 201 with test-fired bullet "3" of exhibit 201

The "RS 22/9/80" test-fired bullet of exhibit 201 had land impression and groove impression widths that were the same widths as the test-fired bullet "3" of exhibit 201.

In contrast to test-fired bullets "3" and "4" of exhibit 201, the "RS 22/9/80" bullet of exhibit 201 did not have clear fine striae within the land impressions of the rifling marks. The land impressions were relatively smooth with only one significant striation noted using the Projectina instrument.

I compared the "RS 22/9/80" bullet of exhibit 201 with test-fired bullet "3" of exhibit 201. I found a correspondence of the major striation noted. In my opinion there was insufficient microscopic detail within the rifling marks of the "RS 22/9/80" bullet to determine conclusively whether or not this bullet had been fired in the Thomas rifle. The correspondence of rifling mark widths and the correspondence of one striation supports the proposition that it has been fired in the Thomas rifle, however I cannot exclude other rifles with the same rifling characteristics.

Comparison of the test-fired bullet of exhibit 209 with test-fired bullet "3" of exhibit 201

The test-fired bullet of exhibit 209 had land impression and groove impression widths that were the same widths as the test-fired bullet "3" of exhibit 201.

Exhibit 209 did not have clear fine striae within the land impressions of the rifling marks. The land impressions were relatively smooth with only a few significant striae noted using the Projectina instrument.

I compared exhibit 209 with test-fired bullet "3" of exhibit 201. I found a correspondence of some of the major striae seen. In my opinion there was insufficient microscopic detail within the rifling marks of exhibit 209 to determine conclusively whether or not this bullet had been fired in the Thomas rifle. The correspondence of rifling mark widths and the correspondence of some striae supports the proposition that it has been fired in the Thomas rifle; however I cannot exclude other rifles with the same rifling characteristics.

From the examinations carried out, it cannot be proved that exhibit 209 was fired in the Thomas rifle. However the correspondence of rifling land and groove widths between exhibit 209 and the bullets test-fired in the Thomas rifle were very good. If exhibit 209 had been fired in a different rifle, I would have expected to have seen perhaps a slight difference in the land and groove widths, with some significant dissimilarities in the microscopic detail within the land impressions. I did not see any significant dissimilarities of either rifling or microscopic detail, but I did see some level of correlation. I found greater correlation between exhibit 209 and bullet "3" of exhibit 201, than between bullet "RS 22/9/80" of exhibit 201 and bullet "3" of exhibit 201.

From my examination of the Eyre rifle in 2006, there can be no doubt that exhibit 209 could not have been fired in that Eyre rifle because the rifle had 5R rifling.

I have also reviewed a letter from Mr Des Thomas to The Commissioner of Police, dated 23 May 2007. I have the following comments on the firearms-related information presented by Mr Thomas:

The Width of Grooves of the Eyre Rifle

It is stated by Mr Thomas that Mr Prescott told the Royal Commission that "the groove on the Thomas test bullet was similar width to the groove on the Eyre test bullet. This means that the test bullet that ESR fired through the Eyre rifle in 2006 must have a groove width of approximately 1.35 to 1.40mm". He also states that "the groove width on the Eyre test bullet is a lot wider so proves beyond doubt that the Eyre rifle has been re-barrelled".

I have attached to this report a copy of a page titled, "Note for file about latest Home Office Report". This is undated but refers to Saturday October 11, (presumably referring to 1980). This indicates that Mr Prescott calls a "groove" on a bullet what I would refer to as a "land impression" (ie. the groove on the bullet impressed by the upraised land in the bore of the barrel). Therefore Mr Prescott has made an observation that the land impressions on the Thomas and Eyre test-fired bullets are approximately the same.

The terminology that I use refers to "lands" in the bore that create "land impressions" in the bullet (Mr Prescott would have called these grooves on the bullet).

I measured the land and groove widths of bullets "3" and "4" of exhibit 201 when I examined them at Archives New Zealand in 2006. These were measured using Vernier callipers. It should be emphasised that measuring rifling width in this manner is not exact, so some tolerance should be allowed for uncertainty. The land measurements varied between 1.55mm and 1.74mm for an average of 1.66mm. The groove measurements varied between 1.31mm and 1.45mm for an average of 1.39mm.

Later in the laboratory I similarly measured the land and groove widths of bullets test fired in the Eyre rifle. These were very difficult to measure as the delineation between the lands and grooves were not often clear. I cast a portion of the bore and directly measured the lands and grooves. The land measurements varied between 1.43mm and 1.50mm for an average of 1.46mm. The groove measurements varied between 1.83mm and 1.96mm for an average of 1.89mm.

The lands of the Thomas rifle and Eyre rifle are therefore approximately 1.66mm and 1.46mm respectively. This difference would be readily discernible if the bullets were compared using a microscope.

Consideration of Barrel Date Codes and Rifle Serial Number for the Remington Model 12

I have seen the information provided by Mr Des Thomas regarding barrel date codes and serial numbers.

I have gathered information regarding the barrel date code and serial number for a number of Remington Model 12 rifles. See Appendix 2. Using the tables provided by Mr Thomas, I have assessed the approximate difference in months between the barrel code and serial number for

the various rifles. Since serial number information has only been compiled for the end of year, I have had to extrapolate between years to estimate the month for each rifle serial number. This assumes constant production during the year, which may not be necessarily correct, but is the best estimate possible from the information provided.

I have graphed this information by year of serial number. In my opinion there is a trend that can be observed. From 1924 to about 1929, the dates from the barrel date codes and serial numbers align well. However after about 1929, the barrel date code becomes progressively in advance of the date estimate for the serial number. This appears to reflect a downturn in production figures and it might be inferred that barrels and receivers are being assembled, and date codes stamped at this time, but serial numbers are not stamped on the rifles until some time later, perhaps as orders are received.

As an example, for Mr Des Thomas' rifle, which has a date code of WT and a serial number of 677644, was assembled in August 1926 and the serial number translates to about September 1926, which, given the uncertainty in serial number stamping, is very close.

The Eyre rifle, which has a date code of DX and a serial number of 786596, was assembled in September 1929 and the serial number translates to about June 1930, which means that the barrel date code was stamped approximately 9 months before the serial number. However from the graph, this appears to be an accurate reflection of how the serial numbers were being stamped increasingly longer after the date codes.

Referring to actual data, rifle 749543 (EW - Oct 1928) has a date code approximately 4 months prior; rifle 800820 (AY - Mar 1930) has a date code approximately 15 months prior; rifle

809696 (CY – Apr 1930) has a date code approximately 24 months prior; rifle 815293 (RY – Nov 1930) has a date code approximately 27 months prior; and rifle 831295 (DB – Sept 1933) has a date code approximately 38 months prior to the serial number stamping.

For some of the rifles for which data was gathered, the data doesn't fit any particular trend. In some cases the date code was marked many years after the serial number. These 'outlier' rifles may have had some changes made to them, such as rebarrelling.

The Eyre rifle date code and serial number appear to reflect other actual recorded rifle data. Therefore, in my opinion, the apparent difference observed between the Eyre rifle date code and serial number does not mean that the rifle has been rebarrelled.

Has the Eyre rifle been rebarrelled?

The following summarises some of the issues;

1. The apparent difference observed between date code and serial number of the Eyre rifle does not mean that the rifle has been rebarrelled. The data actually fits the trend of other observed data very well. Therefore the date code and serial numbers on the Eyre rifle support the proposition that the rifle hasn't been rebarrelled.

2. There is one witness mark on the junction of the barrel and receiver. The marks on the receiver and barrel are aligned. For them to be aligned, either the barrel has not been removed, or the barrel has been put on and purposefully adjusted upon fitting to align the existing witness marks. The absence of another witness mark on the receiver (which would have no corresponding mark on an exchanged barrel) supports the proposition that the rifle hasn't been rebarrelled. A factory rebarrelling would have extra marks stamped on the barrel to indicate

that the Remington factory had rebarrelled the rifle. There were no such extra marks seen on the barrel. I cannot exclude the possibility that someone could replace the barrel without adding another witness mark (but also aligning the existing witness marks).

3. There are no marks on the barrel and receiver that might indicate that tools have gripped these parts to remove and replace the barrel. I am not a gunsmith, but I expect that it is possible to use tools or jigs in a manner that would not mark these parts.

4. The observation by Dr Nelson that bullets test fired in the Eyre rifle in 1970 had 6R rifling is difficult to reconcile. At the Royal Commission, the counsel for DSIR accepted that the Eyre rifle had 5R rifling. If the rifle had not been rebarrelled then either a mistake was made by Dr Nelson in 1970, or bullets allegedly test fired in the Eyre rifle were from another rifle. It is difficult to reconcile how a mistake could have been made by Dr Nelson when the rifling difference on the 5R and 6R bullets is so obvious.

5. Mr Prescott is said to have observed that the 'groove' widths (land impression widths) on the Eyre and Thomas test-fired bullets are similar. There is a small but significant difference between land impression widths of the Eyre and Thomas test-fired bullets. I am unaware of how Mr Prescott made his comparison. If a microscope was not used to make the observation regarding similarity, then it is possible that the term "similar", rather than the terms "same" or "matching", may simply reflect the inaccuracy of a simple visual comparison.

In my opinion there is no physical evidence on the rifle to show that the barrel has been replaced. The strongest evidence to support some exchange of the barrel is the original evidence of Dr Nelson. The presence of a bullet with 6R rifling in the container described as

being a test-fired bullet from the Remington rifle (exhibit 209) also support the proposition that this rifle had a barrel with 6R rifling but this requires Mr Prescott to be wrong in his observations. However from my examination of exhibit 209 and a comparison of it with exhibit 201, there is some support for the proposition that the test-fired bullet of exhibit 209 has actually been test fired in the Thomas rifle, but this could not be conclusively determined.

K Walsh 22 June 2007

Kevan Walsh

Appendix 1. List of items examined.

Exh 29A to 29G: This item was represented by a set of vials and the original packaging for the items. There were seven colour-coded vials, each with a colour-coded unfired cartridge. Separate to the vials was the original packaging for the vials. Inside this packaging were two unfired, brass ICI cartridges with hollow-point lead bullets.

Exh 36: Tools used in the manufacture of cartridge cases.

Exh 39: Three unfired cartridges; "IKC No 4";
"IKC No 3" (Pattern 8 bullet); and
"IKC Wide I".

Exh 42: A pulled cartridge case and an unfired solid lead bullet (1964/2).

Exh 47: Four punch tools ("no. 8") and three unfired (Pattern 8) lead bullets.

Exh 50: Three fired cartridge cases (copper) and three mushroomed, fired lead bullets (from reconstruction 13 October 1970). From the firing pin impressions and the width of the lands and grooves of the bullets, it could be concluded that these items had not been fired in the Thomas rifle.

Exh 53: A pulled ICI brass cartridge case and an unfired solid lead bullet (1964/1).

Exh 55: Tools used in the manufacture of cartridge cases and epoxy disks containing cross-sectioned tools.

Exh 64A: An ammunition packet labelled "ICI High Velocity, Long Rifle, Non-Rusting" (ICI HVLRNR) "Hollow" ammunition. The lot number was 4158.
There was also a separate package containing 33 unfired, brass ICI cartridges with hollow-point lead bullets.

Exh 64B: An ammunition packet labelled "ICI High Velocity, Long Rifle, Non-Rusting" (ICI HVLRNR) "Hollow" ammunition. The lot number was 4184. There

were 34 unfired, brass ICI cartridges. Most had hollow-point lead bullets but at least one cartridge had a solid bullet.

Exh 64C: An ammunition packet labelled "ICI High Velocity, Long Rifle, Non-Rusting" (ICI HVLRNR) "Hollow" ammunition. The lot number was 4295.

In a separate package there were 29 unfired, brass ICI cartridges. They were a mix of ICI headstamps but all were hollow-point lead bullets except for one solid (Pattern 8) bullet.

Exh 65A: An ammunition packet labelled "ICI High Velocity, Long Rifle, Non-Rusting" (ICI HVLRNR) "Hollow" ammunition. The lot number was 3820. There were three unfired, brass ICI cartridges with bullets, as well as two pulled, (unfired) brass ICI cartridges. One lead bullet was loose. One case had the heel of a bullet loose inside the case.

Exh 65B: An ammunition packet labelled "ICI High Velocity, Long Rifle, Non-Rusting" (ICI HVLRNR) "Hollow" ammunition. The lot number was 4103. There were four unfired, brass ICI cartridges with hollow-point lead bullets, as well as one pulled, (unfired) brass ICI cartridge and lead bullet.

Exh 111 (318): An ammunition packet labelled "ICI High Velocity, Long Rifle, Non-Rusting" (ICI HVLRNR) "Hollow" ammunition. The lot number was 4666. There were thirteen unfired, brass ICI cartridges with hollow-point lead bullets, as well as two pulled, (unfired) brass ICI cartridges and lead bullets.

Exh 201: Two packages;

One large vial contained two fired lead bullets. These were Pattern 18 solid bullets. One had "3" and the other "4" scratched onto their base.

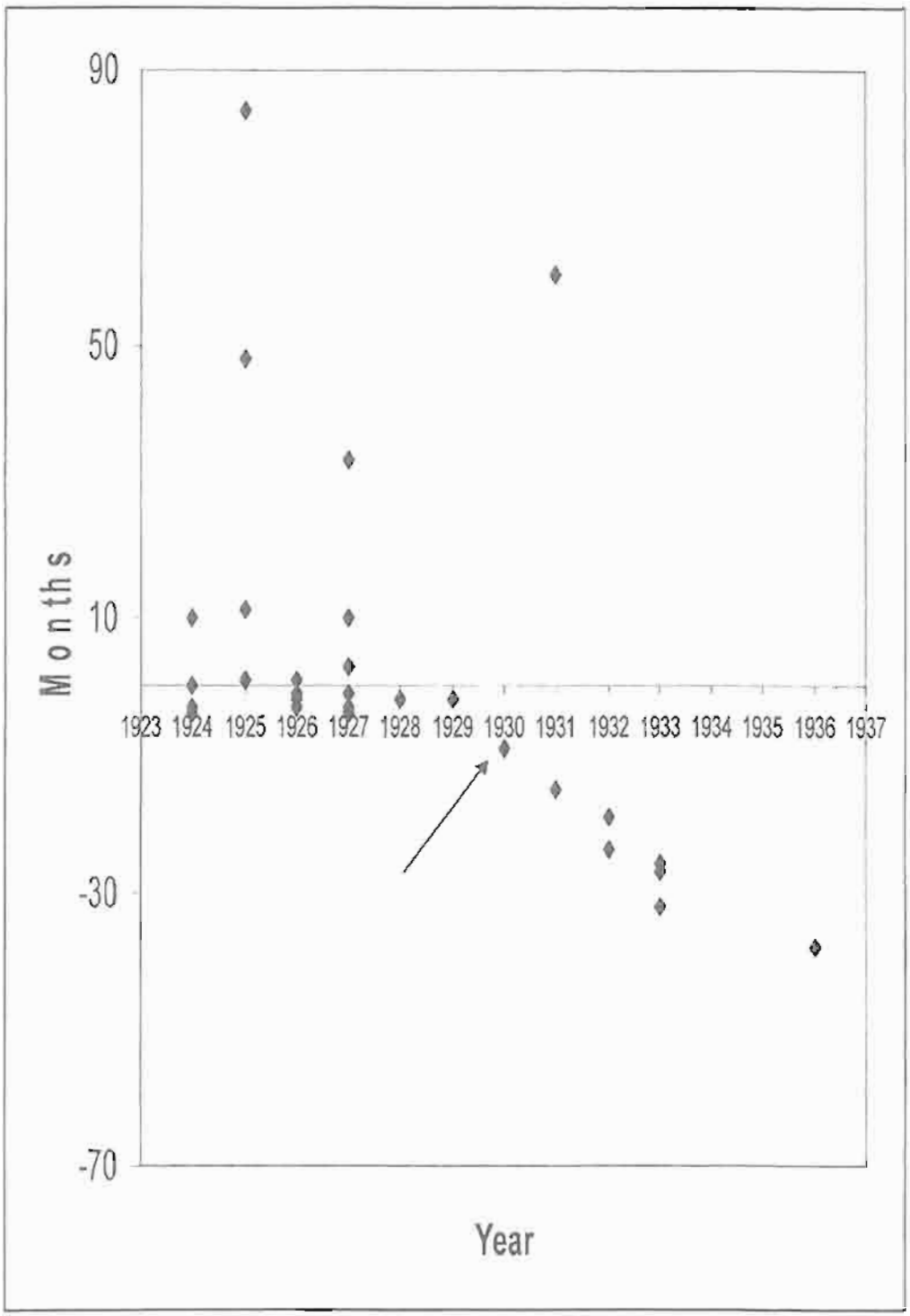
Another smaller vial had a label tied to it. The label described the item as "F bullet test fired from rifle 86942 on 18 Aug 1970". The vial had one fired

Pattern 8D (or Palma) bullet with "RS 22/9/80" scratched onto the base. [This bullet has the number "8" stamped on the base, but is different to the Pattern 8 bullet as it only has two cannelures instead of three. It was usually loaded into a cartridge case with a copper appearance (gilding metal), rather than brass]

Exh 209: One fired Pattern 8 bullet. There was no identification marking scratched onto its base. The labelling associated with this item described it as being "Bullet from Rem rifle test fire".

Appendix 2. Remington Model-12 Barrel Date Code and Serial Number data;
Plot of Months between Date Code and Serial Number vs Year (Serial No.)

(Eyre rifle arrowed)



Month	Year	Month	Year	Serial number	Barrel cod		Serial num	Months		Source
								- before + after		
X	P	Dec	1923	614827						
B	R	Jan	1924	616593						
L	R	Feb	1924	618360						
A	R	Mar	1924	620126						
C	R	Apr	1924	621892						
K	R	May	1924	623658	KR	622851	622xxx	0	Barrel marked same as serial number	JG
					KR	623652	623xxx	0	Barrel marked same as serial number	JG
P	R	Jun	1924	625425	LR	623760	623xxx	-4	Barrel marked 4 months before serial number	JG
O	R	Jul	1924	627191						
W	R	Aug	1924	628957						
D	R	Sep	1924	630723	PR	6316xx	6316xx	-3	Barrel marked 3 months before serial number	Rem Soc Mar 2007
E	R	Oct	1924	632490						
R	R	Nov	1924	634256						
X	R	Dec	1924	636022	ES	637261	637xxx	10	Barrel marked 10 months after serial number	NSW
B	S	Jan	1925	637868						
L	S	Feb	1925	639714						
A	S	Mar	1925	641560	CS-2	639931	639xxx	1	Barrel marked 1 month after serial number	NZ
C	S	Apr	1925	643405						
K	S	May	1925	645251	RX	644625	644xxx	48	Barrel marked 4 years after serial number	JG
					DE	646844	646xxx	84	Barrel marked 11 years after serial number	JG
P	S	Jun	1925	647097						
O	S	Jul	1925	648943	PT	649981	649xxx	11	Barrel marked 11 months after serial number	NSW
W	S	Aug	1925	650789						
D	S	Sep	1925	652635						
E	S	Oct	1925	654480						
R	S	Nov	1925	656326						
X	S	Dec	1925	658172						
B	T	Jan	1926	660313						
L	T	Feb	1926	662455	BT	661503	661xxx	1	Barrel marked 1 month before serial number	JG
A	T	Mar	1926	664596						
C	T	Apr	1926	666737						
K	T	May	1926	668879						
P	T	Jun	1926	671020	KT	670555	670xxx	-1	Barrel marked 1 month before serial number	JG
O	T	Jul	1926	673161	CT	677541	677xxx	-3	Barrel marked 3 months before serial number	JG
W	T	Aug	1926	675303						
D	T	Sep	1926	677444	WT	677644	677xxx	-1	Barrel marked 1 month before serial number	DT
E	T	Oct	1926	679585						
R	T	Nov	1926	681727						
X	T	Dec	1926	683868	E1 (ET?)	683399	683xxx	-2	Barrel marked 2 months before serial number	VIC
B	U	Jan	1927	686487						
L	U	Feb	1927	689106						

A	U	Mar	1927	691725	BY	689308	689xxx	33	Barrel ma	33 months after serial number VIC
					BW	689392	689xxx		Barrel marked 10 months after serial number	JG
					PU	691986	691xxx	3	Barrel marked 3 months after serial number	NSW
C	U	Apr	1927	694344						
K	U	May	1927	696963						
P	U	Jun	1927	699583	AU	697981	697xxx	-3	Barrel marked 3 months before serial number	JG
					AU	698712	698xxx	-3	Barrel marked 3 months before serial number	
					AU	699306	699xxx	-3	Barrel marked 3 months before serial number	
					KU	701771	701xx	-1	Barrel marked 1 month before serial number	NSW
O	U	Jul	1927	702202						
W	U	Aug	1927	704821						
D	U	Sep	1927	707440	KU	707625	707xxx	-4	Barrel marked 4 months before serial number	NSW
E	U	Oct	1927	710059						
R	U	Nov	1927	712678						
X	U	Dec	1927	715297						
B	W	Jan	1928	717938						
L	W	Feb	1928	720580						
A	W	Mar	1928	723221	U	721646	721xxx	-2	Barrel marked in previous year? 2 months +	NZ
C	W	Apr	1928	725863						
K	W	May	1928	728504						
P	W	Jun	1928	731146						
O	W	Jul	1928	733787						
W	W	Aug	1928	736428						
D	W	Sep	1928	739070						
E	W	Oct	1928	741711						
R	W	Nov	1928	744353						
X	W	Dec	1928	746994						
B	X	Jan	1929	749376	RW	751056	751xxx	-2	Barrel marked 2 months before serial number	NSW
L	X	Feb	1929	751758	EW	749543	749xxx	-2	Barrel marked 4 months before serial number	JG
A	X	Mar	1929	754140						
C	X	Apr	1929	756522						
K	X	May	1929	758904						
P	X	Jun	1929	761287						
O	X	Jul	1929	763669						
W	X	Aug	1929	766051						
D	X	Sep	1929	768433						
E	X	Oct	1929	770815						
R	X	Nov	1929	773197						
X	X	Dec	1929	775579						
B	Y	Jan	1930	777231						
L	Y	Feb	1930	778883						
A	Y	Mar	1930	780535						
C	Y	Apr	1930	782187						

K	Y	May	1930	783839						
P	Y	Jun	1930	785492	DX	786596	786xxx	-9	Barrel marked 9 months before serial number	EY
O	Y	Jul	1930	787144						
W	Y	Aug	1930	788796						
D	Y	Sep	1930	790448						
E	Y	Oct	1930	792100						
R	Y	Nov	1930	793752						
X	Y	Dec	1930	795404						
B	Z	Jan	1931	796422						
L	Z	Feb	1931	797440						
A	Z	Mar	1931	798458						
C	Z	Apr	1931	799476						
K	Z	May	1931	800494						
P	Z	Jun	1931	801512	AY	800820	800xxx	-15	Barrel marked 15 months before serial number	JG
O	Z	Jul	1931	802530						
W	Z	Aug	1931	803548						
D	Z	Sep	1931	804566						
E	Z	Oct	1931	805584						
R	Z	Nov	1931	806602						
X	Z	Dec	1931	807620	DE	807084	807xxx	60	Barrel marked 5 years after serial number	JG
B	A	Jan	1932	808180						
L	A	Feb	1932	808741						
A	A	Mar	1932	809301						
C	A	Apr	1932	809862	CY	809696	809xxx	-24	Barrel marked 24 months before serial number	JG
K	A	May	1932	810422	EY	810077	810xxx	-19	Barrel marked 19 months before serial number	JG
P	A	Jun	1932	810983						
O	A	Jul	1932	811543						
W	A	Aug	1932	812103						
D	A	Sep	1932	812664						
E	A	Oct	1932	813224						
R	A	Nov	1932	813785						
X	A	Dec	1932	814345						
B	B	Jan	1933	814869						
L	B	Feb	1933	815394	RY	815293	815xxx	-27	Barrel marked 27 months before serial number	JG
					XY	815314	815xxx	-26	Barrel marked 26 months before serial number	JG
A	B	Mar	1933	815918						
C	B	Apr	1933	816442						
K	B	May	1933	816967						
P	B	Jun	1933	817491						
O	B	Jul	1933	818015						
W	B	Aug	1933	818540						
D	B	Sep	1933	819064						
E	B	Oct	1933	819588	LZ	8198xx	8198xx	-32	Barrel marked 32 months before serial number (white	Rem Soc Oct 2006

R	B	Nov	1933	820113						
X	B	Dec	1933	820637						
B	C	Jan	1934	820901						
L	C	Feb	1934	821164						
A	C	Mar	1934	821428						
C	C	Apr	1934	821691						
K	C	May	1934	821955						
P	C	Jun	1934	822219						
G	C	Jul	1934	822482						
W	C	Aug	1934	822746						
D	C	Sep	1934	823009						
E	C	Oct	1934	823273						
R	C	Nov	1934	823536						
X	C	Dec	1934	823800						
B	D	Jan	1935	824126						
L	D	Feb	1935	824453						
A	D	Mar	1935	824779						
C	D	Apr	1935	825105						
K	D	May	1935	825431						
P	D	Jun	1935	825758						
G	D	Jul	1935	826084						
W	D	Aug	1935	826410						
D	D	Sep	1935	826736						
E	D	Oct	1935	827063						
R	D	Nov	1935	827389						
X	D	Dec	1935	827715						
B	E	Jan	1936	828051						
L	E	Feb	1936	828387						
A	E	Mar	1936	828723						
C	E	Apr	1936	829058						
K	E	May	1936	829394						
P	E	Jun	1936	829730						
G	E	Jul	1936	830066						
W	E	Aug	1936	830402						
D	E	Sep	1936	830738						
E	E	Oct	1936	831073						
R	E	Nov	1936	831409	DB	831295	831xxx	-38	Barrel marked 38 months before serial number	JG
X	E	Dec	1936	831745						

Note for File about latest Home Office Report.

On the evening of Saturday 11 October Detective Chief Superintendent B. Wilkinson and D.F. Nelson rang Mr Prescott to elucidate some of the matters in the latest Home Office Report.

Grooves on Bullets.

When Dr Nelson raised the question of "Grooves" on the bullets Mr Prescott said that in his terminology the land in the rifle produces a groove in the bullet and vice versa. On the other hand Dr Nelsons terminology is that the land in the rifle produces a land-marking on the bullet.

Scoring.

D.F. Nelson uses the term scoring as synonomous with striations in much the same way as Mathews "Fire arms Identification" does on page 39 in line 24 of the first column "Longitudinal striations or tiny groovelets (scorings) which extend across the boundary line .....". Mr Prescott on the other hand would only use the word scoremark or scoring for a gross mark on the bullet due to an unusual defect in the barrel.

When Mr Wilkinson asked Mr Prescott whether if 64 more rifles were gathered he would expect two more which could not be excluded, Mr Prescott replied he would be very surprised if the bullet had been fired in any rifle other than Exhibit 317.

Appendix 8

(5)

Sharon FOWLER, Senior Forensic Scientist, National Ballistics Intelligence Service, Greater Manchester Police, United Kingdom

(2013)

NABIS

Witness Statement

(Criminal Procedure Rules, r27.2);
Criminal Justice Act 1967, s.9; Magistrates' Courts Act 1980, s.5B)

Statement of:	Sharon Fowler	Age: over 18
Occupation of Witness:	Senior Forensic scientist National Ballistics Intelligence Service, Northern Hub, Bradford Park, 3 Bank Street, Manchester, M11 4AA.	
Relating to:	Police reference/OIC:	Crewe Homicide Review/ Detective Superintendent Lovelock

I declare that:

This statement (consisting of fourteen pages each signed by me) is true to the best of my knowledge and belief and I make it knowing that, if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it anything which I know to be false or do not believe to be true;

also that,

I am an expert in a field of forensic science and I have been requested to provide a statement. I confirm that I have read guidance in a booklet known as *Guidance Booklet for Experts - Disclosure: Experts' Evidence, Case Management and Unused Material* which details my role and documents my responsibilities, in relation to revelation as an expert witness. I have followed the guidance and recognise the continuing nature of my responsibilities of revelation. In accordance with my duties of revelation, as documented in the guidance booklet, I

a. confirm that I have complied with my duties to record, retain and reveal material in accordance with the Criminal Procedure and Investigations Act 1996, as amended;
b. have compiled an Index of all material. I will ensure that the Index is updated in the event I am provided with or generate additional material;
c. understand that in the event my opinion changes on any material issue, I will inform the investigating officer, as soon as reasonably practicable and give reasons.

Signed: S Fowler

Dated: 25/04/2013

Qualifications and Experience

I have Honours degrees in both Criminology and Psychology, and have successfully completed a three-year training programme in Forensic Firearms and Toolmark Examinations. I have worked as a forensic scientist specialising in the examination of firearms, ammunition and ammunition components since March 2002. I have completed over 1 700 examinations of the type described below. I am currently employed by the National Ballistics Intelligence Service (NaBIS) as a Senior Ballistics Expert. I am subject to various competency assessments against defined standards for reporting in this area.

Background information

From information received from Detective Superintendent Lovelock from the New Zealand Police, a request was made to NaBIS to re-examine items relating to the fatal shootings of David Harvey Crewe and Jeannette Lenore Crewe in their Pukekawa home on the 16th June 1970. NaBIS agreed to the requests for examinations as stipulated in the "New Zealand Police Report Form" (pages 10 to 12).

Receipt of items

On the 30th October 2012, the following items were hand-delivered by Superintendent Gary Smith of the New Zealand Police to the NaBIS Northern Hub, as part of the Crewe Homicide Review:

Items 1 to 86	Items as detailed in the New Zealand Police Report form (Attached as Appendix A for reference)
Appendix 1	Photographic record of 'Thomas .22 Browning rifle'
Appendix 2	Spreadsheet entitled '.22 Rifle Collection Phase Testing'
Appendices 3 & 4	Photocopies of handwritten notes

All items were correctly and securely packaged, and accounted for, and will be described in further detail below.

Purpose of examination

I have been requested to look at the following (as summarised from the New Zealand Report Form - Appendix A):

a. Examine and compare items 1 to 17 and 19 to 24 to determine how many weapons were used to discharge the items and also to confirm the rifling characteristics of the fired bullets received.
b. To examine the rifle received, item 86, with a view to establishing whether or not it has been altered from its original state, specifically if the barrel has been replaced at some stage.
c. Furthermore, to compare the above items 1 to 17 and 19 to 24 against test fired samples generated from item 86, to determine whether or not any of the fired bullets or cartridge cases were discharged from/in the said weapon.
d. To examine the test fired samples submitted in items 25 to 84 to compare the rifling characteristics of each against the spreadsheet received entitled '.22 Rifle Collection Phase Testing', and to determine whether or not the items contained in items 25 to 84 were correctly eliminated during the original investigation.
e. Finally, I have been asked to compare the fired bullets received in items 1 to 17 and 21 to 23 against item 18, comparison photographs showing side-by-side images of bullets, including those recovered from the fatal shooting incidents.

Initially, I will identify the calibre and rifling of items 1 to 17 and 19 to 24, followed by the microscopical comparison results of these items. I will then discuss my examination of the Remington rifle (item 86) and my findings as to whether any of the items received were discharged from/in the weapon. Then I will discuss my examination of items 25 to 84 and the results thereof. Finally I will address my findings for photographs received in item 18.

Examination and results

A full record of the work undertaken is contained within case notes made at the time of the examination and these are available, for inspection if necessary, at the Hub.

a. Examine and compare items 1 to 17 and 19 to 24 to determine how many weapons were used to discharge the items and also to confirm the rifling characteristics of the fired bullets received.

Item 1 (RCOI Exhibit 201) is a 0.22" calibre, fired bullet, with rifling that bears a right twist, with six lands and six grooves (6R rifling).

Item 2 contains two (2) 0.22" calibre, fired bullets, with 6R rifling.

Item 3 is a 0.22" calibre, fired bullet, with 6R rifling.

Item 4 contains eleven (11) 0.22" calibre, fired bullets with 6R rifling, and eleven (11), 0.22" Long Rifle calibre, fired cartridge cases of the following brands : Eley (6), ICI (1), Winchester (1), Remington (1) and Lapua (2).

Item 5 contains a 0.22" calibre, fired bullet, with 6R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 6 contains a 0.22" calibre, fired bullet, with 6R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 7 contains a 0.22" calibre, fired bullet, with 6R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 8 contains a 0.22" calibre, fired bullet, with rifling that bears a right twist, with five lands and five grooves (5R rifling), and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 9 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 10 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 11 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 12 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 13 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 14 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 15 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 16 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 17 (RCOI Exhibit 209) is a 0.22" calibre, fired bullet, with 6R rifling.

Item 19 is a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 20 is a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 21 contains a 0.22" calibre, fired bullet, with 6R rifling, and a 0.22" Long Rifle calibre, Eley brand, fired cartridge case.

Item 22 contains a 0.22" calibre, fired bullet, with 5R rifling, and a 0.22" Long Rifle calibre, fired Eley brand, cartridge case.

Item 23 contains five (5), 0.22" calibre, fired bullets with rifling consistent with 5 lands and 5 grooves.

Item 24 contains five (5), 0.22" Long Rifle calibre, Federal brand, fired cartridge cases.

Comparison microscopy:

A gun can produce reproducible marks on a cartridge case and bullet/projectile when fired. Some of these firing marks result from general features that may be common to a make or model of weapon (*class characteristic markings*); highly individual aspects of the specific weapon produce others (*individual characteristic markings*). There is a further category of *subclass characteristic markings*, which indicates markings on an item that are more restrictive than class characteristic markings and relate to a smaller group source, but are still insufficient for individualisation purposes. If sufficiently detailed marks are present, the fired cartridge case and/or projectile can be uniquely associated with a particular weapon.

Using a comparison microscope, two ballistic items (cartridge cases/bullets) can be compared simultaneously, as an experienced examiner will determine firstly, if there is agreement of class characteristic markings, and, if there is, will then go on to assess the level of agreement found in the individual characteristic markings of the items to determine whether or not they have been discharged in/from the same weapon.

Many factors can influence the reproducibility of firing marks found on ballistic items, such as the condition of the weapon itself (rust/corrosion, age, cleaning, number of rounds fired in the weapon) and the type of ammunition used (including the bullet and cartridge case materials, cartridge loading) amongst others.

Microscopical results for items with 6R rifling:

In my opinion, a microscopical comparison of firing marks has shown there is sufficient agreement of class and individual characteristic markings to conclusively determine that the bullets contained in items 2 (both bullets), 3, 17 and five of the eleven bullets comprising item 4 were all fired from the same barrel.

In my opinion, a microscopical comparison of firing marks has shown there is some agreement of class and individual characteristic markings on a further two of the bullets comprising item 4, but insufficient detail was found to conclusively determine whether or not they were discharged from the same barrel as the bullets mentioned above.

In my opinion, a microscopical comparison of firing marks has shown there is agreement of class characteristic markings, without sufficient agreement or disagreement of individual characteristic markings, due to an insuffiency of markings, to determine whether or not the bullet from item 1 and the remaining four bullets from item 4 were fired from the same weapon as the bullets, items 2, 3, 4(part) and 17. However, based on class characteristic agreement there is nothing to suggest the involvement of a second barrel.

In my opinion, a microscopical comparison of firing marks has shown there is agreement of class characteristic markings, without sufficient agreement or disagreement of individual characteristic markings, due to the poor (corroded) condition of the bullets, to determine whether or not the bullets from items 5, 6, 7 and 21 were fired from the same weapon as the bullets, items 2, 3, 4(part) and 17. However, based on class characteristic agreement, there is nothing to suggest the involvement of a second barrel.

Microscopical results for items with 5R rifling:

In my opinion, a microscopical comparison of firing marks has shown there is sufficient agreement of class and individual characteristic markings to conclusively determine that the bullets contained in items 8, 9, 10, 14 and 15 were all fired from the same barrel.

In my opinion, a microscopical comparison of firing marks has shown there is agreement of class characteristic markings, without sufficient agreement or disagreement of individual characteristic markings, due to the poor (corroded) condition of the bullets, to determine whether or not the bullets from items 11, 12, 13, 16 and 22 were fired from the same weapon as the bullets mentioned above. However, based on class characteristic agreement, there is nothing to suggest the involvement of a second barrel.

Four of the five bullets contained in item 23 display coarser rifling than those above. However, the fifth bullet, in my opinion, following a microscopical comparison of firing marks, has the same class characteristics as the bullets contained in items 8 to 16 and 22, without sufficient agreement or disagreement of individual characteristic markings to determine whether or not it was discharged from the same weapon as these items, but there is nothing to suggest the use of a second barrel.

In my opinion, a microscopical comparison of firing marks has shown there is sufficient agreement of class and individual characteristic markings to conclusively determine that the remaining 4 bullets from item 23 were discharged from the same barrel. In my opinion, the gross detail present on these 4 bullets is consistent with markings seen on bullets fired through a heavily-fouled barrel. Therefore, whilst I am unable to microscopically associate these bullets to those above, in my opinion, there is nothing to suggest the use of a second weapon.

Microscopical results for the cartridge cases:

In my opinion, a microscopical comparison of firing marks has shown there is sufficient agreement of class and individual characteristic markings, to conclusively determine that the cartridge cases contained in items 4, 5, 6, 7 and 21 were fired in the same weapon.

In my opinion, a microscopical comparison of firing marks has shown there is sufficient agreement of class and individual characteristic markings to conclusively

determine that the cartridge cases contained in items 8 to 16, 19, 20, 22 and 24 were all fired in the same firearm.

In my opinion, a microscopical comparison of firing marks has shown there is significant disagreement of individual characteristic markings to conclusively determine that the two sets of cartridge cases mentioned above were discharged in different weapons.

b. To examine the rifle received, item 86, with a view to establishing whether or not it has been altered from its original state, specifically if the barrel has been replaced at some stage.

Examination of Item 86

Item 86 is a 0.22" nominal calibre, Remington model 12, pump-action rifle, with serial number 786596, and integrated tubular magazine.

During my examination of the rifle, I noted the degree of fouling present within the barrel, which made a visual count of the rifling difficult. I also noted a degree of corrosion deposited over the surface of the weapon.

Nonetheless, the rifle is in working order and has been successfully test fired during examination using commercial 0.22" Long Rifle calibre ammunition.

The test fired bullets from the rifle, item 86, display coarse firing marks, which would be expected for lead bullets fired from a fouled barrel. The rifling characteristics on the bullets are 5R.

In order to determine if the barrel of the weapon has been altered or replaced at any stage, along with my visual examination, I have compared it with a Remington model 12 rifle from the laboratory's reference collection. During this examination, I noted no evidence of any alteration to item 86. Furthermore, the corrosion noted during the initial examination is evenly deposited over the weapon, including the

barrel/magazine/receiver areas. Additionally, the reference weapon also has 5R rifling.

The manufacturer identification markings on the barrel and receiver of item 86 are consistent with markings seen on the reference weapon. The barrel length and overall length of both weapons corresponds with the manufacturer specifications for this model.

Therefore, in my opinion, the barrel on item 86 is the original barrel.

During the process of examination, I received a further request from Superintendent Lovelock to establish the date of manufacture of the Remington rifle, item 86. A query was sent to Remington Arms with the serial number and model of the weapon and they determined it was manufactured in 1930.

c. Furthermore, to compare the above items 1 to 17 and 19 to 24 against test fired samples generated from item 86, to determine whether or not any of the fired bullets or cartridge cases were discharged from/in the said weapon.

In my opinion, a microscopical comparison of firing marks has shown there is sufficient agreement of class and individual characteristic markings to conclusively determine that the cartridge cases found in items 8 to 16, 19, 20, 22 and 24 were all fired in item 86.

Unfortunately, due to the condition of the barrel of item 86, it is not possible to determine whether or not the bullets found in items 8 to 16, 22 and 23 were fired from item 86. However, as the bullets recovered from the fatal shootings have a 6R rifling form and both the above bullets and the rifle, item 86, have 5R rifling, therefore in my opinion, this weapon should have been eliminated from the original investigation, and no further examination is warranted.

d. To examine the test fired samples submitted in items 25 to 84 to compare the rifling characteristics of each, against the spreadsheet received entitled '.22 Rifle Collection Phase Testing', and to determine whether or not the items contained in items 25 to 84 were correctly eliminated during the original investigation.

Examination of items 25 to 84

In order to complete the requested examination of items 25 to 84, an assessment was made of the images contained in item 18 with an aim to establishing class characteristic features that would assist in the elimination process. From the examination of the photographs and information contained in the New Zealand Police Report Form, it was taken that the test bullets in the photographs had 6R rifling, and, more specifically, were consistent with markings found on items 1, 2, 3, 4, 5, 6, 7, 17 and 21, in terms of agreement of the land and groove widths.

The examination of the test fired items began with identifying the items which have a rifling form other than 6R. Below is a table summarising those items with rifling types confirmed as not being 6R, and therefore, correctly eliminated during the original investigation.

Crewe Ref	Tag no	Rifling		Crewe Ref	Tag no	Rifling
26	P28B	4R		27	P21A/P21B	4R
28	P2A/P2B	4R		29	C2B	8R
31	P15B	4R		34	K2B	4R
36	P11B	4R		38	M1A	4R
40	K1B	4R		42	P20B	4R
43	C17A	6L		44	P19B	8R
47	P6A/P6B	4R		48	C7B	4R
49	P7B	4R		50	P4B	4R
52	C16B	4R		54	P25B	6L
55	P26A/P26B	4L		58	P24B	4R
59	C4A	R (worn)		62	P9B	4R

Crewe Ref	Tag no	Rifling		Crewe Ref	Tag no	Rifling
66	C5A	4R		70	P5A	4R
71	H1A	4R		72	P10B	4R
73	MC2A	4R		74	MC1A	4R
82	G2B	5R		83	MO1B	6L

During the comparison microscopy completed on items 1 to 7, 17 and 21, I noted certain reproducible characteristic features at the base of the bullets. Examination of the photographs contained in item 18 also identified similar features at the base of the bullets on both the test fired bullets and the bullets recovered from the fatal shootings (exhibits 234 and 289). In order to determine whether or not these features were suitable for identification purposes, I needed to identify the weapon photographed in Appendix A, presumed to be the Browning weapon mentioned in the New Zealand Police Report form, to see if a similar weapon would also produce the markings found on the items mentioned above.

I determined the weapon to be most similar to a 0.22" calibre, FN Browning Trombone (pump-action) rifle. I obtained such a weapon from the laboratory's reference collection in order to generate test-fired samples for comparison purposes. While examining the test-fired bullets microscopically, I noted similar characteristic features at the base of the bullets that I had noted on items 1, 2, 3, 4, 5, 6, 7, 17 and 21, as well as in the photographs contained in exhibit 18. However, similar types of markings were also found on some of the test fired bullets contained in items 25 to 84, identified from the supplied spreadsheet as having been discharged in a self-loading or pump-action rifle. Thus, the features are more likely to be associated with the firing process for this type of rifle rather than markings derived from defects within the barrel that would be useful for identification purposes. Nonetheless, the markings observed on the test fired bullets from the FN rifle were more distinct than the other manufacturers in this batch of test fired samples examined, and while these features did not provide a basis for identification, they would assist in the process of sifting through the test fires.

Using the class characteristic features of the 6R items, including their land and groove widths as a guide, along with the characteristic features at the base of the bullets discussed previously, below is a table with the items identified as having 6R rifling and a comment regarding their comparison against the items 1, 2, 3, 4, 5, 6, 7, 17 and 21, as well as in the photographs contained in exhibit 18:

Crewe ref	Tag no	Rifling & comment		Crewe ref	Tag no	Rifling & comment
57	P22B	6R -more narrow		68	C14B	6R - narrow
77	F3B	6R - same class characteristics		64	C9A	6R - more narrow
56	P3B	6R -more narrow		33	P18B	6R - wider
41	P29B	6R -more narrow		46	P8B	6R - more narrow
76	F1A	6R - more narrow		84	Cullen1B/ CC1B	6R - more narrow
69	C6B	6R -wider		61	P1B	6R - more narrow
60	C11A	6R - more narrow		80	F1B	6R - more narrow
30	C16B/P16B	6R - more narrow		51	C1A	6R - more narrow
35	C12B	6R - more narrow		37	M2A	6R - more narrow
78	L1A	6R - more narrow		65	C13B	6R - more narrow
63	C15B	6R - more narrow		81	G1B	6R - more narrow
67	P13B	6R - more narrow		32	P17B	6R - more narrow
45	P27B	6R - more narrow		39	P14B	6R - more narrow
79	S1B	6R - more narrow		75	F2B	6R - more narrow
53	P23B	6R - more narrow		25	C8B	6R - more narrow

Following my examination of the above and based on class characteristic markings and the characteristic features at the base of the bullet discussed above, I would be unable to exclude item *F3B* from the original investigation.

e. Finally, I have been asked to compare the fired bullets received in items 1 to 17 and 21 to 23 against item 18, comparison photographs showing side-by-side images of bullets, including those recovered from the fatal shooting incidents.

Based on the findings above and subclass characteristic carryover noted between items fired in different weapons but of the same make and model, it is not possible to determine if any of the features captured in the photographs contained in item 18 are genuine *individual* characteristics or *subclass* characteristics. Therefore, in my opinion, without a physical examination of items 234 and 289, it is not possible to reach a conclusion as to whether or not the items 234 and 289 were fired from the same barrel as items 1, 2, 3, 4, 5, 6, 7, 17 and 21, from the photographs provided, although the possibility cannot be discounted.

All critical findings contained in this statement have been subject to peer review.

S Fowler

NABIS

EXPERT'S INDEX OF UNUSED MATERIAL

EXPERT'S Reference: Crewe Homicide Review

CJS URN:

A listing of **all** the unused material held in relation to this case by:

The following is a list of all the unused material in the possession of the above named expert in this case (Note, the material should be considered to be NON-SENSITIVE, unless a specific flag exists to suggest it might be SENSITIVE). The list is provided in accordance with the guidance given in *'Disclosure: Expert's evidence and unused material -Guidance Booklet for Experts'*

EXPERT'S USE			CPS USE	
No	Description of material	Location	Insert C,I or CND	Comment
1	**FORMS** detailing: Receipt and Dispatch of items to NaBIS; movement of items within and between hubs; Submission forms detailing nature of offence, work required and details of suspects, victims etc	Case files		
2	**CASE NOTES** made at the time of the examination of the items with details of dates of examinations; details of packaging and integrity of items; records of work performed on the items, who was involved and dates; analytical and test results; details of quality checks	Case files		
3	**DRAFT REPORTS** electronic and/or hard copy drafts of reports or statements sent out to the Prosecution Team	Case file/ IT media		
4	**MINUTES** of any conversations with and instructions to other staff; records of any conversations with the OIC and other police personnel; records of any conversations with the Prosecutor and other CPS personnel.	Case file		
5	**RECORDS** of any material submitted but not examined; of any material examined but relating to suspects not included in reports or statements; of any work carried out by others, including the results; of procedures and techniques used during the examinations	Case file		
6	**RETAINED MATERIALS.** Test-fired samples from Item 86 (transferred to New Zealand Police as requested)	Transferred to NZ Police		

Completed by: Sharon Fowler

Signed: S Fowler

Dated: 17rd May 2013

Reviewing Lawyer
Signature:
Dated:

NEW ZEALAND POLICE
REPORT FORM

SUBJECT:	CREWE Homicide Review
TEXT:	FORENSIC EXAMINATION BY NaBIS

Detective Superintendent LOVELOCK
Crewe Homicide Review
COUNTIES-MANUKAU

19 October 2012

1. Purpose:

1.1 This report is a briefing document for staff engaged in the re-examine of ballistic related Exhibits relating to the murders of David Harvey CREWE and Jeannette Lenore CREWE in their Pukekawa home on 16 June 1970.

2. Introduction:

2.1 In June 1970 New Zealand Police commenced an investigation into the murder of (David) Harvey CREWE and his wife, Jeannette Lenore CREWE, at their rural Pukekawa farm house. Their only child, Rochelle, was found alone in her cot. The Police investigation resulted in the arrest and prosecution of a local man, Arthur Allan THOMAS, for their murders.

2.2 In March 1971, THOMAS was convicted following a trial in the Auckland Supreme Court. He was sentenced to a double life term of imprisonment. Following a successful Appeal, he was re-tried in 1973 which resulted in an identical outcome.

2 3 Following his convictions the Arthur THOMAS Re-Trial Committee Inc., was formed and lobbied tirelessly on his behalf. In 1978 the New Zealand Prime Minister of the day, the Rt. Hon. Robert MULDOON, engaged Mr Robert ADAMS-SMITH QC to examine the circumstances resulting in the conviction of Arthur THOMAS to see whether or not he had genuinely been the subject of a miscarriage of justice.

2.4 Following receipt of a second ADAMS-SMITH report in December 1979 and against advice from the Solicitor General Mr Richard Savage QC, the Governor General, Sir Keith HOLYOAKE, on advice from the Prime Minister exercised the 'Royal Prerogative of Mercy' and on 17 December 1979, Arthur THOMAS was pardoned and immediately released from Prison.

2.5 Following the pardon and release of THOMAS, the Minister of Justice Mr J.K. McLAY engaged the services of Justice TAYLOR, an Australian New South Wales High Court Judge, to Chair a Royal Commission of Inquiry into the circumstances resulting in the conviction of Arthur THOMAS for the murder of the CREWES.

APPENDIX A
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In the Royal Commission of Inquiry report released in 1980, Justice TAYLOR concluded that Detective Inspector HUTTON, the Officer-in-Charge of the Investigation; and the late Detective Lenrick JOHNSTON, a member of the Investigation Team, were both guilty of fabricating evidence against Arthur THOMAS.

2.6 The arrest and conviction of Arthur THOMAS has continued to capture the imagination of the New Zealand media like no other case before or since and numerous books, publications and films have resulted.

2.7 In October 2010, Rochelle CREWE, approached Police in Auckland and for the first time sought answers to a number of questions relating to the death of her parents.

2.8 In recognition of the high level of public interest this case has generated for the past four decades, Police Commissioner Howard BROAD provided Rochelle CREWE with an assurance that Police would do what they could to provide her with answers to the questions that she had raised. Further, he informed her that he had appointed a Detective Superintendent to lead a small team of experienced analysts and investigators to fully 'assess and review' the 1970 Police investigation.

2.9 One of the many points of contention surrounding this case is centred on the quality of the ballistics testing carried out by Government Forensic Scientists engaged by Police.

2.10 The Police Team reviewing the case seek to bring some clarity to this area of the evidence.

2.11 Note: For the purposes of this report the term "bullet" refers to the lead projectile only.

3. Background:

3.1 On 22 June 1970, South Auckland couple, Harvey and Jeannette CREWE, were reported missing from their Pukekawa farmhouse which had been discovered insecure leaving their 18 month old child home alone in her cot. Evidence at the scene suggested that the CREWES' had been absent from their home for up to five days. Blood and brain tissue located in the lounge and kitchen area indicated that one or both had been the victim of foul play.

3.2 On 16 August 1970, the body of Jeannette CREWE was recovered from the Waikato River. A post-mortem examination revealed she had received a single gun shot wound to the head. Twelve fragments of a .22 calibre bullet were extracted from her head. The most intact fragment was assigned Police Exhibit number 234 and the remainder, Police Exhibit number 257.

3.3 Embossed into the concave base on the largest fragment of the bullet (Police Exhibit 234) was a number '8'. This identified the bullet as being a pattern '8' bullet manufactured by the Colonial Ammunition Company (CAC) in Auckland and loaded into Long Rifle cartridge shells manufactured by the ammunition Division of ICI Australia Limited (ICI). Enquiries indicate that some 158 million bullets of this type were manufactured until production stopped on 8 November 1963.

3.4 Further examination revealed that the bullet, although badly damaged, had been fired through a weapon with a rifling configuration of six lands and grooves with a right hand twist.

3.5 The Department of Scientific and Industrial Research (DSIR) Government Forensic Analyst Dr Donald NELSON stated that four clear lands, and most of the fifth, were discernable on the damaged exhibit.

3.6 On 16 September 1970, the body of Harvey CREWE was recovered from the Waikato River. A post-mortem examination revealed that he had also received a single gun shot wound to the head. Nine fragments of a .22 calibre bullet were extracted from his head and assigned Police Exhibit number 289.

3.7 Although this bullet was more extensively damaged than that recovered from his wife, a number '8' could also be seen embossed in the concave base of one of the fragments and one land mark was visible. The width of this land mark was consistent with the width of the land mark seen in Police Exhibit 234.

3.8 Dr NELSON was of the opinion that both bullets (Police Exhibits 234 and 289), were consistent with having been fired through the same .22 calibre barrel.

3.9 Police commenced collecting .22 calibre firearms from residents living within a five mile radius of the CREWE farmhouse in Pukekawa. Later, the Police collection plan extended to include .22 calibre firearm holders residing in the greater Auckland area who were friends of, or had been associated with the CREWES'.

3.10 Police took possession of a total of sixty-four .22 calibre firearms.

3.11 Two of the rifles seized were:

(i) a Browning Pump action rifle, serial No.86942 (later assigned Police Exhibit 317 - and known as the 'THOMAS Rifle');
(ii) a Remington Pump action rifle, Serial No.786596 (later assigned Police Exhibit C3B - known as the 'EYRE Rifle').

3.12 On 18 August 1970, Dr NELSON test-fired twenty-one .22 calibre rifles using copper cartridges. Three rounds were fired through each rifle. The discharged bullets were then compared with the bullet fragments recovered from the deceased, namely Police Exhibits 234 and 289.

3.13 Dr NELSON was unable to exclude a Browning Pump action rifle serial No.86942, Police Exhibit 317 and the Remington Pump action rifle serial No.786596, Police Exhibit C3B as having fired the fatal bullets.

3.14 Later, a further forty-three (43) .22 calibre firearms were test-fired by DSIR Forensic Analysts. All of these firearms were able to be excluded by Dr NELSON, as having fired the fatal bullets.

3.15 Notwithstanding further examination of the test-fired rounds from both the Browning Pump action rifle (Police Exhibit 317); and the Remington Pump action rifle (Police Exhibit C3B), Dr NELSON was unable to conclusively confirm or eliminate either of the two firearms as having fired the fatal bullets.

3.16 On 2 March 1971, Arthur THOMAS, the owner of the Browning Pump action firearm (Police Exhibit 317) was convicted of the murders of Harvey and Jeannette CREWE.

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3.17 In early 1972, Mr THOMAS successfully appealed his conviction and a retrial was ordered. In mid-1972, on request of Defence Counsel for THOMAS, a decision was made to send the Browning Pump action firearm (Police Exhibit 317) and relevant shell cases; and bullets, to forensic experts in England for further examination and analysis.

3.18 On 2 August 1972, Mr George PRICE, Principal Scientific Officer, Home Office Forensic Science Laboratory reported on his examination of the items forwarded to him.

3.19 Mr PRICE's examination included, but was not limited to, test-firing the Browning Pump action firearm (Police Exhibit 317) and taking a number of comparison photographs between a test-fired bullet purportedly fired through the Browning Pump action firearm (Police Exhibit 317) and Police Exhibits 234 and Police Exhibit 289.

3.20 In April 1973, Arthur THOMAS was found guilty for a second time of the murders of Harvey and Jeannette CREWE.

3.21 On 27 July 1973, Police destroyed a number of Police exhibits by disposing of them at the Whitford Tip, in South Auckland. This included Police Exhibits 234, 257, and 289.

3.22 As detailed in paragraph 2.4 above, Arthur THOMAS was pardoned on 17 September 1979.

4. Royal Commission of Inquiry:

4.1 On 24 April 1980, a Royal Commission of Inquiry (RCOI) was convened in Auckland, to enquire into the circumstances resulting in the conviction of Arthur THOMAS for the murder of the CREWE's. One aspect of the RCOI involved re-consideration of the ballistic evidence overall.

4.2 During the hearing the RCOI was asked by Counsel representing the Police, Mr John HENRY and Mr Robert FISHER to allow the evidence of Mr PRICE to be heard concerning his examination of the Police Exhibit 317 and the bullets. Mr PRICE had since retired and was unfit to travel to New Zealand.

4.3 Mr Peter PRESCOTT had taken over the role of Mr PRICE as a Ballistics Expert with the Home Office and had reviewed his predecessor's work, including a number of comparison photographs purportedly showing comparisons between test-fired bullets from the Browning Pump action firearm (Police Exhibit 317) and Police Exhibits 234 and 289. He reported on his findings on 30 September 1980.

4.4 Mr PRESCOTT travelled to New Zealand for the purposes of giving evidence before the RCOI.

4.5 In October 1980, Mr PRESCOTT arrived in New Zealand. He was asked by Mr KEYTE QC, Counsel assisting the RCOI, to differentiate between the bullets fired in the Browning (Police Exhibit 317) and Remington (Police Exhibit C3B) rifles.

4.6 On 27 October 1980 Mr PRESCOTT test-fired both firearms, and compared the test-fired bullets. His findings identified that although the groove width was similar on bullets from both rifles, the land width was quite different and the bullets fired in the Police Exhibit C3B rifle had five grooves, whilst the bullets fired in Police Exhibit 317 had six grooves.

4.7 Mr PRESCOTT determined that the bullet recovered from Jeannette CREWE showed the presence of six grooves.

4.8 Mr PRESCOTT was prepared to report to the RCOI that he supported the findings of Mr PRICE, having reviewed his work and photographs. On 29 October 1980, when comparing the bullets test-fired from the THOMAS rifle (Police Exhibit 317), Mr PRESCOTT noticed marks similar to those visible on Mr PRICE's photographs taken in 1972 and was prepared to present his expert opinion to the RCOI.

4.9 As it transpired, Justice TAYLOR did not allow Mr PRESCOTT to produce or refer to Mr PRICE's photographs before the RCOI due to the fact that the provenance of the photographs had not been established to his satisfaction.

4.10 Whilst giving his evidence to the RCOI, Mr PRESCOTT presented a bullet he had test-fired on 28 October 1980 from the Remington rifle (Police Exhibit C3B) to support his findings. This item was assigned RCOI Exhibit number 209.

4.11 Dr NELSON was also called to give evidence before the RCOI. During the course of his evidence he produced a bullet he had test-fired on 18 August 1970 from the Browning rifle (Police Exhibit 317). This was assigned the reference RCOI Exhibit 201.

5. Further Forensic Analysis:

5.1 Supporters of Arthur THOMAS assert that a member of another Pukekawa family is the person responsible for the CREWE murders. They insist that John Michael EYRE used the Remington rifle (Police Exhibit C3B) which Dr NELSON had (erroneously) been unable to exclude following his original examination as being the firearm used to murder the CREWES'.

5.2 The THOMAS family refuse to accept Mr PRESCOTT's findings that the Remington rifle (Police Exhibit C3B) contained a rifled barrel with five lands and grooves with a right hand twist.

5.3 Since 1999, Arthur THOMAS' brother, Desmond, has corresponded with Police, requesting them to re-examine Mr PRESCOTT's findings; and to re-examine the Remington rifle (Police Exhibit C3B).

5.4 On 20 December 2004, Forensic Scientist, Dr Nicholas POWELL and Desmond THOMAS visited Archives New Zealand where the 1970 CREWE Homicide investigation files and a number of the Exhibits produced at the RCOI (and retained), are stored. Dr POWELL, together with Mr THOMAS, examined RCOI Exhibit 209. As a result of this examination, Dr POWELL concluded that RCOI Exhibit 209 bore six land marks of approximately equal widths to the groove marks and had been fired from a rifled barrel with a right-hand twist. These findings implied that Dr NELSON's 1970 examination was accurate and Mr PRESCOTT's findings were not.

5.5 Following this development, both Dr POWELL and Desmond THOMAS wrote to Police requesting that the Remington rifle (Police Exhibit C3B) be re-examined.

5.6 In 2006, the Environmental and Science Ltd (ESR), who provide forensic services to New Zealand Police, engaged Forensic Analyst Mr Kevan WALSH, to examine the Remington rifle (Police Exhibit C3B) in the presence of Desmond THOMAS and Dr POWELL.

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Mr WALSH confirmed that this firearm in fact had five lands and grooves with a right hand twist, and not six as had earlier been asserted by Dr NELSON in 1970.

5.7 Following this examination Desmond THOMAS requested that RCOI Exhibit 209 be forensically re-examined. This request was agreed to by Police and subsequently Mr WALSH, in the presence of Dr POWELL, examined a .22 bullet (RCOI Exhibit 209) and determined that this Exhibit had been fired through a rifled barrel with six lands and grooves with a right-hand twist.

5.8 On 14 June 2007, Mr WALSH, again at the request of Police, conducted an examination of the RCOI Exhibits at Archives New Zealand, in the presence of Inspector John WALKER, Dr POWELL, and Desmond THOMAS

5.9 Upon opening the envelope containing RCOI Exhibit 201, Mr WALSH found three .22 calibre bullets inside, when there should have only been one, indicating contamination or mislabelling of the exhibit and a consequential loss of integrity.

5.10 Mr WALSH described two of these three bullets as having the numbers '3' and '4' respectively, scratched on their bases.

5.11 Mr WALSH identified the third bullet as being a pattern 8D (Palma) fired bullet (bullet). Scratched on the base of this bullet was "RS 22/9/80". It is accepted by the Crewe Review Team that the initials "RS" are those of Forensic Analyst Mr Rory SHANAHAN who worked along side Dr NELSON during the original investigation in 1970 and during the 1980 RCOI.

5.12 Mr WALSH examined bullets '3' and '4' and concluded that both of them had been discharged from the same firearm.

5.13 Upon comparing the Palma bullet with test-fired bullet numbered '3', Mr WALSH found a *'correspondence of a major striation'* in both of these bullets, however, he concluded that there was insufficient microscopic detail within the rifling marks of these two bullets to determine conclusively whether or not the Palma bullet had been fired in the THOMAS rifle. (Police Exhibit 317).

5.14 Mr WALSH then compared the test-fired bullet of RCOI Exhibit 209 with the test-fired bullet marked '3' from the envelope labelled '201'. Upon completion of this examination, Mr WALSH concluded that RCOI *"Exhibit 209 had land impression and groove impression widths that were the same widths as the test-fired bullet '3' of exhibit 201"*. He *"found a correspondence of some of the major striae seen"*, but in his opinion *"there was insufficient microscopic detail within the rifling marks of exhibit 209 to determine conclusively whether or not this bullet had been fired in the THOMAS rifle"* (Police Exhibit 317).

5.15 Mr WALSH concluded that the correspondence of rifling mark widths and the correspondence of some striae support the proposition that it had been fired by the Browning rifle (Police Exhibit 317), however, he could not exclude other rifles with the same rifling characteristics. Mr WALSH further stated that he found greater correlation between Exhibit 209 and bullet '3' of Exhibit 201 than between bullet 'RS 22/09/80' of Exhibit 201 and bullet '3' of Exhibit 201.

5.16 Finally, Mr WALSH further examined the Remington rifle (Police Exhibit C3B) in response to Mr THOMAS's amended claim that the barrel of this rifle had been altered.

5.17 Upon physical examination and subsequent collation and analysis of forensic data relating to firearms of this and similar specifications, including the manufacturer's specifications, Mr WALSH concluded that there was no physical evidence to show that the barrel of the Remington rifle had been replaced.

6. Exhibits - Current Status:

6.1 In 2012, the CREWE Review Team initiated enquiries to locate all remaining bullets test-fired during the course of the CREWE Homicide Investigation. An analysis and review of (i) Police, (ii) Archive New Zealand files, ESR (formerly DSIR) have established that bullets and photographs are still available for examination.

These items are described as follows:

Item 1 — RCOI Exhibit 201, a bullet purportedly test-fired in the Browning rifle (Police Exhibit 317) by NELSON on 18 August 1970.

Item 2 — Two bullets purportedly test-fired on 26/06/1972 from the Browning rifle (Police Exhibit 317) by DSIR Forensic Analyst Mr SHANAHAN.

Item 3 — One bullet purportedly test-fired from the Browning rifle (Police Exhibit 317) by Mr PRICE in July 1972 for comparison with samples sent to him by New Zealand Police.

Item 4 — Eleven bullets purportedly test-fired from the Browning rifle (Police Exhibit 317) by Mr Price in July 1972 for comparison with samples sent to him by New Zealand Police.

Item 5 — One bullet and one cartridge case purportedly test-fired from the Browning rifle (Police Exhibit 317) on 27/10/1980 by Mr PRESCOTT.

Item 6 — One bullet and one cartridge case purportedly test-fired from the Browning rifle (Police Exhibit 317) on 27/10/1980 by Mr PRESCOTT.

Item 7 — One bullet and one cartridge case purportedly test-fired from the Browning rifle (Police Exhibit 317) on 27/10/1980 by Mr PRESCOTT.

Item 8 — One bullet and one case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.

Item 9 — One bullet and one case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.

Item 10 — One bullet and one case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.

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Item 11	One bullet and one case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.
Item 12	One bullet and one case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.
Item 13	One bullet and one case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.
Item 14	One bullet and one cartridge case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr PRESCOTT.
Item 15	One bullet and one cartridge case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 27/10/1980 by Mr PRESCOTT.
Item 16	One bullet and one cartridge case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 27/10/1980 by Mr PRESCOTT.
Item 17	RCOI Exhibit 209, a bullet purportedly test-fired in the Remington rifle (Police Exhibit C3B) on 27/10/80 by Mr PRESCOTT.
Item 18	Comparison photographs purporting to show comparisons between a test-fired bullet fired from Police Exhibit 317 and Exhibits 234 and 289. (Origin Home Office, Midlands Forensic Science Laboratory records, Mr PRICE).
Item 19	One case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.
Item 20	One case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 15/10/1980 by Mr SHANAHAN.
Item 21	One bullet and one cartridge case purportedly test-fired from the Browning rifle (Police Exhibit 317) on 27/10/1980 by Mr PRESCOTT.
Item 22	One bullet and one cartridge case purportedly test-fired from the Remington rifle (Police Exhibit C3B) on the 27/10/1980 by Mr PRESCOTT.
Item 23	Five bullets purportedly test-fired from the Remington rifle (Police Exhibit C3B) on 13/03/2006 by Mr Welsh.
Item 24	Five cartridge cases purportedly test-fired from the Remington rifle (Police Exhibit C3B) on 13/03/2006 by Mr WELSH.
Items 25 to 84	A number of bullets and cartridge cases purportedly test-fired between 18 August 1970 and 6 October 1970 from various firearms collected by Police from (i) Pukekawa area residents; or (ii) associates of Harvey and Jeannette CREWE.

Item 85 CD of photographs depicting Items 1 to 84 outlined above.

Item 86 Remington rifle (Police Exhibit C3B).

6.2 The CREWE Review Team has taken possession of the Remington rifle (Police Exhibit C3B) from the family that it was originally seized from in 1970.

6.3 The Browning rifle (Police Exhibit 317) was returned to Arthur THOMAS following the findings of the RCOI or as a consequence of the pardon. The CREWE Review Team are not in a position to obtain possession of that firearm.

6.4 As requested photographs of the firearm have been enclosed as **Appendix 1.** The quality of these photographs is poor.

6.5 The CREWE Review Team has created a spreadsheet entitled .22 Rifle Collection Phase Testing. This captures from documentation off the Police file all firearms seized by Police during the initial investigation. The spreadsheet outlines:

- from whom firearm seized
- Make (of firearm)
- Type
- Serial Number
- Date seized
- Police Reference number
- Date firearm test-fired by DSIR and number of rounds fired through firearm
- Notations from the examining scientist identifying barrel rifling direction to the right or to the left
- Number of lands
- Notes recorded by scientist
- Date firearm returned to owner
- Page reference from the file
- Test-fired bullets / cartridges in Police custody

This has been attached as **Appendix 2**.

6.6 Note: A number of discrepancies were identified by the Crewe Review Team over the Tag Numbers assigned to various firearms. These are:

- The Tag Number assigned to a firearm seized from William Robert CHANDLER is variously referred to as P21B and P21A.
- The Tag Number assigned to a firearm seized from Robin William DUNLOP is variously referred to as P2B and P2A.
- The Tag Number assigned to a firearm seized from Raymond Leslie FOX is variously referred to as P6B and P6A.
- The Tag Number assigned to a firearm seized from Richard Leonard HANSEN is variously referred to as P26B and P26A.
- The Tag Number assigned to a firearm seized from Peter Bain McKAY is variously referred to as CC1B and Cullen (1)B.

6.7 It is understood that Dr NELSON and other scientists completing work in respect of this investigation had notebooks in which they recorded their workings. Dr NELSON's notebook can not be found.

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The file does, however, contain four pages of handwritten notes purportedly written by Dr NELSON and which appear to be notes made by him during his examination of some of the 64 rifles seized by Police. These notes have been attached for your information as **Appendix 3.**

6.8 The file also contained a further 8 pages of handwritten notes which appear to relate to the test firing of the 64 firearms. The author of these pages is unknown but possibly a technician assisting Dr NELSON. These notes have been attached for your information as **Appendix 4.**

7. Purpose of Examination

7.1 The review is endeavouring to establish:-

(i) Establish whether there is any evidential basis and to what degree for the proposition that the Browning rifle (Police Exhibit 317) is the murder weapon;

(ii) Establish whether there is any evidential basis; and to what degree for the proposition, that the Remington rifle (Police Exhibit C3B) is the murder weapon;

(iii) If there is any evidence to indicate that the Remington rifle (Police Exhibit C3B) has been re-barrelled;

(iv) Establish whether or not the bullets assigned RCOI Exhibit References 201 and 209 are consistent or identical to those linked to the Browning Rifle (Police Exhibit 317) and / or the Remington Rifle (Police Exhibit C3B).

(v) Establish whether the 62 rifles test-fired in 1970 by DSIR scientists and eliminated as being the murder weapon were correctly eliminated from the investigation.

8. Examination Sought (Forensic with Supporting Photographic Imagery)

8.1 Concerning Browning rifle (Police Exhibit 317)

(a) We seek a comparison to be made of Items 1, 2, 3, 4, 5, 6, 7 and 21 as described in paragraph 6.1, to confirm that each of the bullets so identified were fired through the same barrelled firearm.

(b) We seek confirmation that all the bullets contained within Items 1, 2, 3, 4, 5, 6, 7 and 21 as described in paragraph 6.1 are consistent with having been fired through a rifled barrel with six lands and grooves with a right hand twist.

(c) We seek an examination of the photographs described in Item 18, of paragraph 6.1 and on the basis that the photographs show a comparison between a test-fired bullet from the Browning rifle (Police Exhibit 317) and the bullet taken from the head of Jeannette CREWE (Police Exhibit 234) and the bullet taken from the head of Harvey CREWE (Police Exhibit 289), report on the extent to which the photographs provide an evidential basis that the Browning rifle (Police Exhibit 317) fired the fatal bullets (Police Exhibits 234 and 289).

(d) We seek a comparison to be made of bullets specified as Items 1, 2, 3, 4, 5, 6, 7 and 21 as described in paragraph 6.1 with the photographic images of Police Exhibit 234 and Police Exhibit 289 specified as Item 18 in paragraph 6.1 and report as to the degree of agreement that the bullets correspond with the fatal bullets (Police Exhibit 234 and 289).

(e) We seek any additional examination that you are able to undertake in order to best achieve the outcomes sought in sub-paragraphs (a) - (d) above.

8.2 Concerning Remington rifle (Police Exhibit C3B)

(a) We seek a non-invasive forensic examination of the Remington rifle (Police Exhibit C3B), now labelled Crewe Review Exhibit 86, to establish whether there is any evidence to suggest that the weapon has been re-barrelled or modified.

(b) We seek to have the Remington rifle (Crewe Review Exhibit 86) test-fired and confirm that it has a rifled barrel with five lands and grooves with a right-hand twist.

(c) We seek confirmation that each of the bullets described within Items 8, 9, 10, 11, 12, 13, 14, 15, 16, 22 and 23 described in paragraph 6.1, are consistent with having been fired through a rifled barrel with five lands and grooves with a right-hand twist.

(d) We seek a comparison of the test-fired bullets from your test firing of the Remington rifle (Crewe Review Exhibit 86) with bullets from Items 8, 9, 10, 11, 12, 13, 14, 15, 16, 22 and 23 as described in paragraph 6.1 and confirm that Items 8, 9, 10, 11, 12, 13, 14, 15, 16, 22 and 23 had been fired through the same barrel.

(e) We seek a comparison of bullets from your test firing of the Remington rifle (Police Exhibit C3B) with the bullet described in Item 17 (RCOI Exhibit 209) as described in paragraph 6.1, to establish if it had been fired through the same barrel.

(f) We seek a comparison of the firing pin impression from your test-fired cartridge cases with the cases in Items 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 22 and 24 to confirm that the firing pin impressions are the same.

(g) We seek a comparison of bullets contained within Items 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 22 and 23 with the photographic images of Police Exhibit 234 and Police Exhibit 289 described in Item 18 of paragraph 6.1 and report as to the degree of agreement that the bullets correspond with the fatal bullets.

8.3 Concerning Examination of Items 25 to 84

(a) We seek an examination of each item to confirm the number of lands and groves and direction of rifling twist of each bullet is in agreement with that recorded against the item in the attached spreadsheet entitled .22 Rifle Collection Phase Testing and labelled **Appendix 2**.

APPENDIX A

(b) We seek a comparison to be made of the bullets identified as having six lands and groves with a right hand rifling twist with the photographic images of Police Exhibit 234 and Police Exhibit 289 described in Item 18 of paragraph 6.1 and report as to the degree of agreement that any of these bullets correspond with the fatal bullets.

Explanatory Note:

In New Zealand, the High Court is prepared to accept relevant evidence that meets "best evidence" rule criteria. For example, if a .22 calibre bullet (a Police Exhibit) had been discarded but a photographic representation of the bullet remained, subject to the provenance being established satisfactorily, the Court would accept this evidence.

In terms of the examination that is being sought from the National Ballistics Intelligence Section (NaBIS), the New Zealand Police are seeking a highly qualified Scientist in this specialised area to undertake a non-invasive comparison of physical items with forensic photographic images of the subject bullets (Police Exhibits 234 & 289) and draw authoritative conclusions that may, if necessary, translate to formal testimony in a criminal proceeding.

Report submitted for your consideration and direction please.

G. LENDRUM
Detective Senior Sergeant GL6248
Crewe Homicide Review
Counties-Manukau

CREWE REVIEW INVENTORY - BULLETS CASINGS FOR NaBIS

Date Test Fired	Exhibit Description	Location	Item No:	CREWE Ref No.	Exhibit Bag Ref No.	Exhibits Rec'd/Returned
THOMAS RIFLE - TEST FIRED ROUNDS						
18/08/1970	NELSON test fire - RCOI Exhibit 201	Archives NZ - COM40 201	1 Bullet	1	314314	
26/06/1972	SHANAHAN "3" - RCOI Exhibit 201	Archives NZ - COM40 201	1 x Bullet	2	314315	
	SHANAHAN "4" - RCOI Exhibit 201	Archives NZ - COM40 201	1 x Bullet	2	314315	
July 1972	PRICE - M22/72 - Lab Test	Police - Home Office File	1 x Bullet	3	314316	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
	- Tests	Police - Home Office File	1 x Bullet, 1 x Case	4	314317	
27/10/1980	PRESCOTT 1805 hrs - Batch 1346	Archives NZ - COM40 1	1 x Bullet, 1 x Case	5	314318	
	PRESCOTT 1805 hrs - Batch 1346	Archives NZ - COM40 2	1 x Bullet, 1 x Case	6	314319	
	PRESCOTT 1805 hrs - Batch 1346	Archives NZ - COM40 6	1 x Bullet, 1 x Case	7	314320	
	PRESCOTT 1805 hrs - Batch 1346 - 3	ESR Mt Albert - PET06175/4/1	1 x Bullet, 1 x Case	21	314336	

CREWE REVIEW INVENTORY - BULLETS CASINGS FOR NaBIS

Date Test Fired	Exhibit Description	Location	Item No:	CREWE Ref No.	Exhibit Bag Ref No.	Exhibits Rec'd/Returned
EYRE RIFLE - TEST FIRED ROUNDS						
15/10/1980	SHANAHAN 1st Sequence -1- Police	Police [redacted]	1 x Bullet, 1 x Case	8	314321	
	SHANAHAN 1st Sequence -2- Police	Police [redacted]	1 x Bullet, 1 x Case	9	314322	
	SHANAHAN 1st Sequence -3- Police	Police [redacted]	1 x Bullet, 1 x Case	10	314323	
	SHANAHAN 3rd Sequence -7- KEYTE	Archives NZ - COM40 12 & 7	1 x Bullet, 1 x Case	11	314324	
	SHANAHAN 3rd Sequence -8- KEYTE	Archives NZ - COM40 10 & 8	1 x Bullet, 1 x Case	12	314325	
	SHANAHAN 3rd Sequence -9- KEYTE	Archives NZ - COM40 11 & 9	1 x Bullet, 1 x Case	13	314326	
	SHANAHAN 4th Sequence -11- DSIR	ESR PET06175/4/3	1 x Case	19	314331	
	SHANAHAN 4th Sequence -12- DSIR	ESR PET06175/4/4	1 x Case	20	314332	
27/10/1980	Batch 1346 - for Mr PRESCOTT	Archives NZ - COM40 3	1 x Bullet, 1 x Case	14	314327	
	Batch 1346 - for Prof.MOWBRAY	Archives NZ - COM40 4	1 x Bullet, 1 x Case	15	314328	
	Batch 1346 - for Prof.MOWBRAY	Archives NZ - COM40 5	1 x Bullet, 1 x Case	16	314329	
	RCOI - Exhibit 209	Archives NZ - COM40 209	1 Bullet	17	314330	
	Batch 1346 - 3	ESR PET06175/4/2	1 x Bullet, 1 x Case	22	314333	
13/03/2006	WALSH - ESR - 5 rounds, one bullet	ESR PET06175/2	1 x Bullet	23	314335	
	marked with a 1, all others unmarked.	ESR PET06175/2	1 x Bullet	23	314335	
	"	ESR PET06175/2	1 x Bullet	23	314335	
	"	ESR PET06175/2	1 x Bullet	23	314335	
	"	ESR PET06175/2	1 x Bullet	23	314335	
	WALSH - spent case: K1	ESR PET06175/3	1 x Case	24	314334	
	WALSH - spent case: K2	ESR PET06175/3	1 x Case	24	314334	
	WALSH - spent case: K3	ESR PET06175/3	1 x Case	24	314334	
	WALSH - spent case: K4	ESR PET06175/3	1 x Case	24	314334	
	WALSH - spent case: K5	ESR PET06175/3	1 x Case	24	314334	
EYRE RIFLE						
	Remington Pump Action Rifle Serial No: 786596	Police Secure Store	1 x Rifle	86		

CREWE REVIEW INVENTORY - BULLETS CASINGS FOR NaBIS

Date Test Fired	Exhibit Description	Location	Item No:	CREWE Ref No.	Exhibit Bag Ref No.	Exhibits Rec'd/Returned
TEST FIRED ROUNDS 18 AUGUST 1970 TO 6 OCTOBER 1970						
18/08/1970	C8B	2 bullets & 2 cases	PET06175 - B/2	25	AKCBA1485767	
	P28B	2 bullets & 2 cases	PET06175 - B/2	26	AKCBA1485767	
	P21B	2 bullets & 2 cases	PET06175 - B/2	27	AKCBA1485767	
	P2A	2 bullets & 2 cases	PET06175 - B/2	28	AKCBA1485767	
	C2B	2 bullets & 2 cases	PET06175 - B/2	29	AKCBA1485767	
	P16B (Item also labelled C16B)	2 bullets & 2 cases	PET06175 - B/2	30	AKCBA1485767	
	P15B	2 bullets & 2 cases	PET06175 - B/2	31	AKCBA1485767	
	P17B	1 bullet & 2 cases	PET06175 - B/2	32	AKCBA1485767	
	P18B	1 bullet & 2 cases	PET06175 - B/2	33	AKCBA1485767	
	K2B	2 bullets & 2 cases	PET06175 - B/2	34	AKCBA1485767	
	C12B	2 bullets & 2 cases	PET06175 - B/2	35	AKCBA1485767	
	P11B	2 bullets & 2 cases	PET06175 - B/2	36	AKCBA1485767	
	M2A	2 bullets & 2 cases	PET06175 - B/2	37	AKCBA1485767	
	M1A	2 bullets & 2 cases	PET06175 - B/2	38	AKCBA1485767	
	P14B	2 bullets & 2 cases	PET06175 - B/2	39	AKCBA1485767	
	K1B	2 bullets & 2 cases	PET06175 - B/2	40	AKCBA1485767	
	P29B	2 bullets & 2 cases	PET06175 - B/2	41	AKCBA1485767	
	P20B	2 bullets & 2 cases	PET06175 - B/2	42	AKCBA1485767	
	C17A	2 bullets & 2 cases	PET06175 - B/2	43	AKCBA1485767	
	P19B	2 bullets & 2 cases	PET06175 - B/2	44	AKCBA1485767	
	P27B	2 bullets & 2 cases	PET06175 - B/2	45	AKCBA1485767	
	P8B	2 bullets & 2 cases	PET06175 - B/2	46	AKCBA1485767	
	P6A	2 bullets & 2 cases	PET06175 - B/2	47	AKCBA1485767	
	C7B	2 bullets & 2 cases	PET06175 - B/2	48	AKCBA1485767	
	P7B	2 bullets & 2 cases	PET06175 - B/2	49	AKCBA1485767	
	P4B	2 bullets & 2 cases	PET06175 - B/2	50	AKCBA1485767	
	C1A	2 bullets & 2 cases	PET06175 - B/2	51	AKCBA1485767	
	C16B	2 bullets & 3 cases	PET06175 - B/2	52	AKCBA1485767	
	P23B	2 bullets & 2 cases	PET06175 - B/2	53	AKCBA1485767	
	P25B	2 bullets & 2 cases	PET06175 - B/2	54	AKCBA1485767	
	P26A	2 bullets & 2 cases	PET06175 - B/2	55	AKCBA1485767	
	P3B	5 bullets & 5 cases	PET06175 - B/2	56	AKCBA1485767	
	P22B	2 bullets & 2 cases	PET06175 - B/2	57	AKCBA1485767	
	P24B	2 bullets & 2 cases	PET06175 - B/2	58	AKCBA1485767	

CREWE REVIEW INVENTORY - BULLETS CASINGS FOR NaBIS

Date Test Fired	Exhibit Description	Location	Item No:	CREWE Ref No.	Exhibit Bag Ref No.	Exhibits Rec'd/Returned
	C4A	2 bullets & 2 cases	PET06175 - B/2	59	AKCBA1485767	
	C11A	3 bullets & 3 cases	PET06175 - B/2	60	AKCBA1485767	
	P1B	2 bullets & 2 cases	PET06175 - B/2	61	AKCBA1485767	
	P9B	2 bullets & 2 cases	PET06175 - B/2	62	AKCBA1485767	
	C15B	2 bullets & 2 cases	PET06175 - B/2	63	AKCBA1485767	
	C9A	2 bullets & 2 cases	PET06175 - B/2	64	AKCBA1485767	
	C13B	2 bullets & 2 cases	PET06175 - B/2	65	AKCBA1485767	
	C5A	2 bullets & 2 cases	PET06175 - B/2	66	AKCBA1485767	
	P13B	2 bullets & 2 cases	PET06175 - B/2	67	AKCBA1485767	
	C14B	2 bullets & 2 cases	PET06175 - B/2	68	AKCBA1485767	
	C6B	2 bullets & 2 cases	PET06175 - B/2	69	AKCBA1485767	
	P5A	2 bullets & 2 cases	PET06175 - B/2	70	AKCBA1485767	
	H1A	2 bullets & 2 cases	PET06175 - B/2	71	AKCBA1485767	
	P10B	2 bullets & 2 cases	PET06175 - B/2	72	AKCBA1485767	
	MC2A	2 bullets & 2 cases	PET06175 - B/2	73	AKCBA1485767	
	MC1A	2 bullets & 2 cases	PET06175	74	AKCBA1485767	
	F2B	2 bullets & 2 cases	PET06175	75	AKCBA1485767	
	F1A	2 bullets & 2 cases	PET06175	76	AKCBA1485767	
	F3B	2 bullets & 2 cases	PET06175	77	AKCBA1485767	
	L1A	2 bullets & 2 cases	PET06175	78	AKCBA1485767	
	S1B	2 bullets & 2 cases	PET06175	79	AKCBA1485767	
	F1B	2 bullets & 2 cases	PET06175 - B/2	80	AKCBA1485767	
	G1B	2 bullets & 2 cases	PET06175 - B/2	81	AKCBA1485767	
	G2B	2 bullets & 2 cases	PET06175 - B/2	82	AKCBA1485767	
	M01B	2 bullets & 2 cases	PET06175 - B/2	83	AKCBA1485767	
	CULLEN (1)B	2 bullets & 2 cases	PET06175 - B/2	84	AKCBA1485767	

CREWE REVIEW INVENTORY - BULLETS CASINGS FOR NaBIS

Date Test Fired	Exhibit Description	Location	Item No:	CREWE Ref No.	Exhibit Bag Ref No.	Exhibits Rec'd/Returned
PHOTOGRAPHS						
July 1972	Talyronds & comparison polaroids of fatal bullets and test fired bullets taken by Mr PRICE - Home Office Ballistics Unit	Police - Home Office File	23 polaroids	18	314337	
October 2012	CD containing photographs of all exhibits as listed above	Police - CREWE Homicide Review Team	1 x CD	85		
	Booklet of Photographs of Browning Rifle	Police - CREWE Homicide Review Team	1 x Booklet	Appendix 1		
DOCUMENTS						
	List of Firearms seized by Police during original investigation	Police Homicide Review Team	1 x Spreadsheet	Appendix 2		
	Handwritten Notes - purportedly written by Dr Donald NELSON	Police Homicide Review Team	4 x pages	Appendix 3		
	Handwritten Notes	Police Homicide Review Team	8 x pages	Appendix 4		

Appendix 8

(6)

Report on the examination of photographs of bullets and bullet comparisons relating to the Crewe homicides,

by Kevan WALSH,

ESR Scientist, Auckland, New Zealand (2014)

Report on the Examination of Photographs of Bullets and Bullet Comparisons Relating to the Crewe Homicides. K. Walsh, ESR.

A number of items have been submitted for examination and comparison. These items are listed in Appendix 1. They included twenty-three Polaroid photographs of bullet comparisons and various test-fired bullets and cartridge cases. The bullets and cartridge cases were described as having been test fired in rifles belonging to Mr Arthur Thomas, Mr Richard Thomas and Mr [redacted] Eglinton.

The bullets and cartridge cases that had been test-fired in the rifle belonging to Mr Arthur Thomas were prepared in the 1970s by Dr D. Nelson and Mr R. Shanahan of the Department of Scientific and Industrial Research (DSIR) in New Zealand; and by Mr Price and Mr. Prescott of the Home Office in England. The bullets and cartridge cases that had been test-fired in the rifle belonging to Mr [redacted] Eglinton were prepared in the 1970s by Dr D. Nelson of the DSIR. The bullets and cartridge cases that had been test fired in the rifle belonging to Mr Richard Thomas were prepared in 2013 by Mr G. Wevers of the Institute of Environmental Science and Research Ltd (ESR).

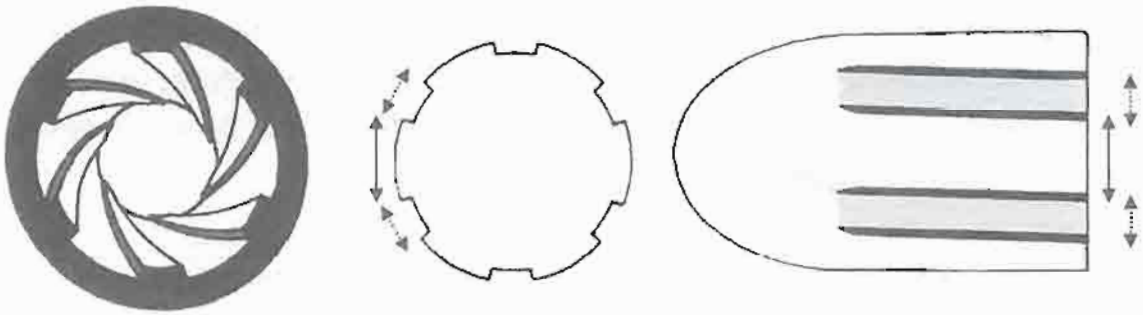
The Polaroid photographs had been taken in the 1970s by Mr Price in England during his examination of bullets that had been test fired in Mr Arthur Thomas' rifle and comparisons with bullet fragments recovered from the body of Mr Harvey Crewe (exhibit 289) and Mrs Jeannette Crewe (exhibit 243).

Introduction to Firearms Identification

The forensic discipline of "firearms identification" refers to the science of determining if a bullet, cartridge case or other ammunition component was fired by or loaded in a particular firearm. Therefore a bullet recovered from a crime scene could be compared to a bullet that has been test fired in a rifle, to determine whether or not that rifle was used to fire the bullet recovered from the crime scene.

A rifle has a barrel that has helical grooves cut into the bore of the barrel to impart rotary motion to a bullet, which in turn imparts rotational stability to the bullet in flight. Shown in Figure 1 is a diagrammatical view of the interior of a rifled barrel. This barrel has six grooves

cut into the barrel and as a result, there are six raised areas which are referred to as lands. When a bullet is fired down the barrel, the lands and grooves of the barrel impart land and groove impressions on the bearing surface of the bullet.



Rifled barrel (6-right) Base of fired bullet Side view of fired bullet

Figure 1. Rifling Characteristics. From left to right; view down the rifled barrel with six grooves with a right-hand twist – the greyed areas are the grooves cut into the bore of the barrel. The remaining raised areas are called 'lands'; view of the base of a bullet fired down the barrel; and side view of a bullet fired down the barrel. The dashed double-arrowed lines indicate the width of each land impression. i.e. that area of the surface of the bullet that has been cut away by the raised land on the bore of the barrel. The bold double-arrowed line indicates the width of the groove impression, which is that area of the surface of the bullet that has been forced into the groove cut into the bore of the barrel.

A bullet fired down a barrel will have land and groove impressions that match the number and width of the lands and grooves of the barrel. These are referred to as rifling "class characteristics". Therefore class characteristics are features that are determined by design. Two fired bullets with the same number of groove impressions of the same width have the same class characteristics and therefore could have been fired in the same rifle. Conversely, two fired bullets with either a different number of groove impressions, or with the same number of groove impressions but of a different width, can be excluded from having been fired in the same rifle.

The correspondence of class features (number of land and groove impressions and their width) between a recovered bullet and a bullet test-fired in a rifle means that there is some evidence to support the proposition that the rifle that was tested fired the recovered bullet. The rifle therefore cannot be excluded from having fired the recovered bullet. It would then be appropriate to carry out an extensive microscopic comparison of the detail within the land and

groove impressions of the recovered and test-fired bullets to investigate further whether or not the rifle indeed fired the recovered bullet.

When a bullet is fired down the barrel, as well as being marked by the land and groove impressions, the bullet is also marked by the random imperfections present on the surface of the bore of the barrel. These imperfections are produced incidental to manufacture and are also caused by wear and tear, corrosion, or other damage to the bore of the barrel. On the fired bullet, these barrel imperfections create very microscopic linear scratches on the bearing surface of the bullet as the bullet passes down the barrel. These striae are created within the land and groove impressions and are called "striations" or "striae". A significant correspondence of these striae between two fired bullets, in conjunction with the correspondence of the number and dimensions of the land and groove impressions, can be used to conclusively identify a particular rifle as having fired the bullet.

Test Firing For Microscopic Comparisons

To determine if a particular firearm was used to fire a bullet recovered from a crime scene, that firearm is used to test fire bullets for comparison to the recovered bullet.

Appropriate ammunition of the correct calibre and type is selected for test firing. A number of cartridges (perhaps five) are test fired to obtain a range of test-fired bullets.

With a number of test-fired bullets, comparisons can be made of these bullets to assess the variability between bullets known to have been fired in the firearm. This can be used to assist in the interpretation of the findings of a comparison. If there are significant differences between test-fired bullets, then this may impact upon the interpretation of a comparison where there is little similarity.

Use of the comparison microscope for firearms identification

Figure 2 shows a comparison microscope used in the 1970s. This instrument effectively combines two microscopes.

To carry out a comparison, the bullet recovered from the crime scene is placed on one of the stages, say on side B. One of the test-fired bullets is mounted on Stage A. An appropriate

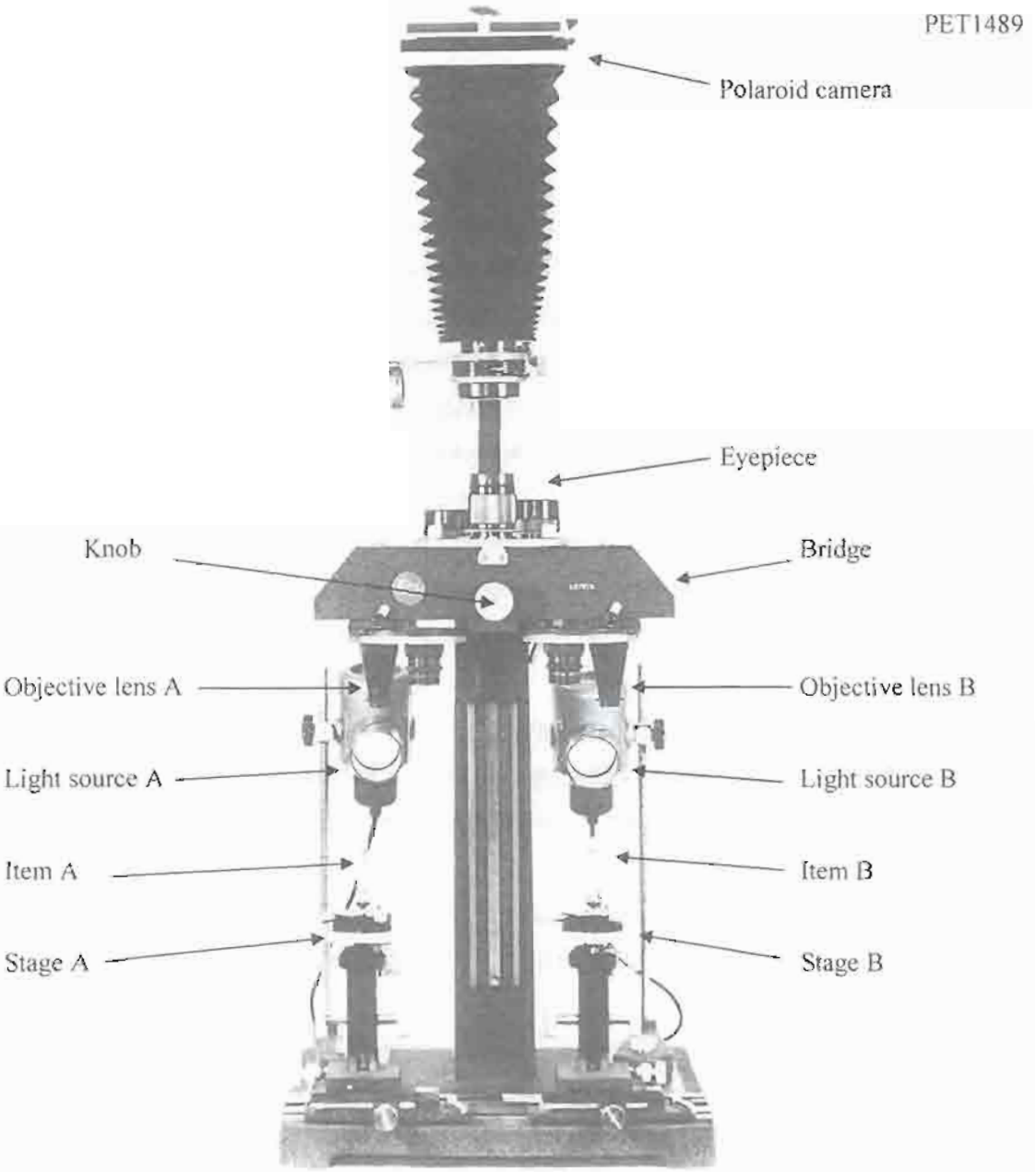


Figure 2. Comparison Microscope used at DSIR in the 1970s. This instrument is effectively two microscopes, on sides A and B. One bullet is mounted on Stage A and the other bullet is mounted on Stage B. A light source for each stage illuminates each bullet at an angle, to cast shadows from features (e.g. striae) on the surface of each bullet. Light from bullets A and B is magnified through the respective objective lenses (three choices of lens on a rotating turret) and then reflected off a mirror within the bridge above the objective lens towards another mirror below the eyepiece. The examiner looks down the eyepiece (which also has some magnification) to a mirror within the bridge which allows the examiner to view each bullet at one time. By rotating a knob at the front of the microscope, the examiner can see more or less of one side. The Polaroid camera mounted above the microscope can take a photograph of the view that can be seen through the eyepiece.

magnification is chosen by rotating the turret containing the three objective lenses to select the same lens for each side of the microscope. The light source for each stage is adjusted to be at the same angle and distance from the respective bullets. The angle is chosen to cast shadows from the features on the surface of each bullet. When the examiner looks down the eyepiece, the bullet on each stage can be viewed at the same time. Each stage can be manipulated to align the two bullets in the field of view. The bullets can be rotated on the stage to view subsequent land and groove impressions.

The bullets are positioned so that they effectively overlay each other in the field of view. By rotating a knob at the front of the microscope, the examiner can see more or less of each side, and therefore see more or less of each bullet. The ability to effectively traverse along the length of the overlapping bullets allows the examiner to observe correspondences and differences along the entire bearing surface of the bullets. When a photograph is taken, the photograph only shows one discrete snapshot of a complete comparison using the microscope. Photographs are generally used as a later reminder for the examiner as to the quality of the comparison. Although some observations may be made by another examiner viewing the photographs, the photographs present far less information than that which is seen by the examiner using the microscope.

In carrying out the comparison, firstly the class characteristics, such as the width of the land and groove impressions are compared. If the test-fired item and the questioned item display differing class features, the firearm is excluded from having fired the bullet recovered from the crime scene. If there is a class correspondence, then the striae present within the land and groove impressions can be compared.

When a significant correspondence is observed between the striae, not only should the prominent features align between the recovered bullet and the test-fired bullet, in position and apparent shape, but there should also be an overwhelming similarity and no unexplained dissimilarity.

Figure 3 shows a comparison of two test-fired bullets. Both were fired in Mr Arthur Thomas' rifle. One was test fired by Mr Price and the other by Mr R. Shanahan. This comparison shows that for the land impression in the centre of the photograph, there are many striae

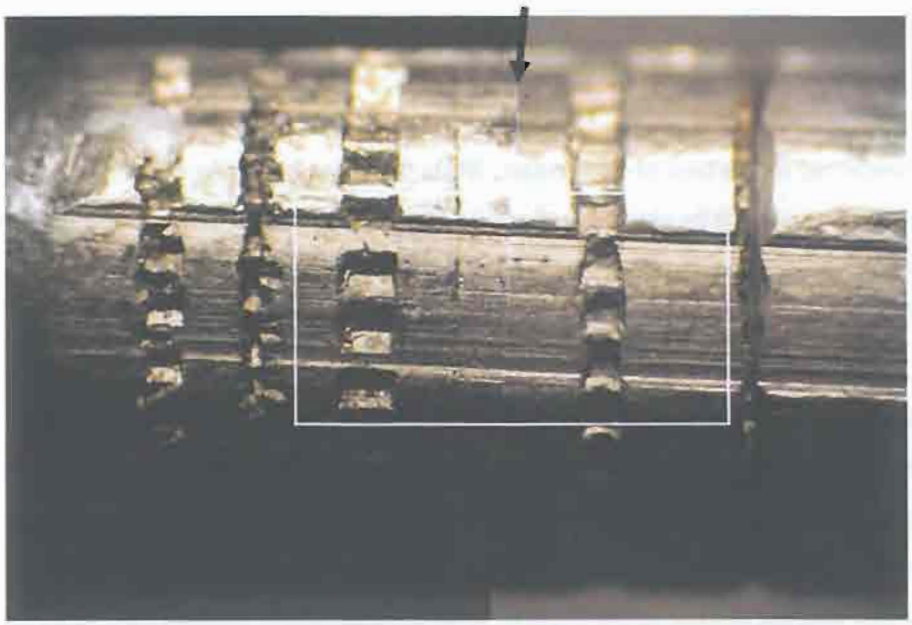


Figure 3. Comparison of two test-fired bullets. On the left is the bullet test-fired in Mr Arthur Thomas' rifle by Mr Price. On the right is one of the two bullets (201-3) test-fired in Mr Arthur Thomas' rifle by Mr R. Shanahan. The dividing line between the two bullets is indicated by a black arrow. The area within the white box is shown in Figure 4. The red arrows indicate corresponding striae. The yellow arrows indicate non-corresponding striae.

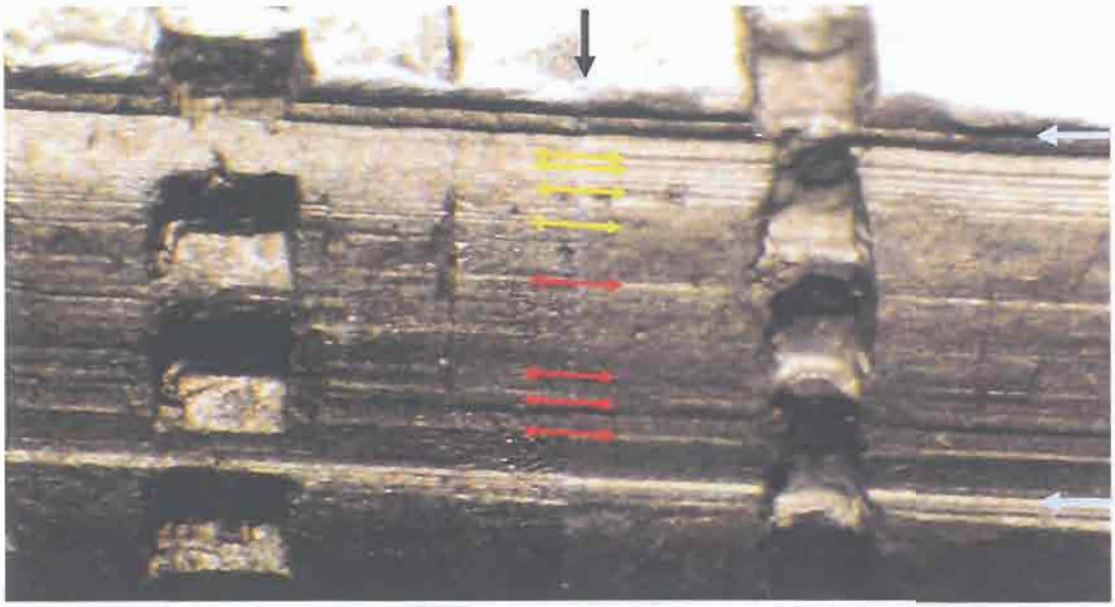


Figure 4. Close-up of the comparison of the two test-fired bullets shown within the white box seen in Figure 3. The dividing line between the two bullets is indicated by a black arrow. The edges of the land impression are shown by blue arrows. The red arrows indicate examples of corresponding striae. The yellow arrows indicate examples of non-corresponding striae.

running parallel to the length of the land impression. Some corresponding striae are seen on both test-fired bullets but there are some striae on one bullet that are not seen on the other bullet. This is not unusual and shows the variability that can occur between shots fired in the same rifle.

If, upon microscopic comparison of the recovered and test-fired bullets, there is observed a lack of clarity of microscopic features on the recovered bullet, or there are few features corresponding and the correspondence is of low quality, then no conclusive finding may be reached regarding the question of whether the rifle had fired the bullet. It is very unlikely that as a result of such a comparison that the rifle can be excluded from having fired the bullet. Even if there is an apparent poor correspondence of features, the rifle may not be able to be excluded because the surface features of the bore are constantly but slowly changing. It is not uncommon, for there to be no significant correspondence between two bullets test fired in the same rifle.

Sub-class characteristics

On occasions, some manufacturing techniques can impart the same microscopic features onto consecutively manufactured items. These are referred to as "Sub-class characteristics". If two bullets share the same sub-class characteristics then this means that they relate to a smaller group source or subset of the class to which they belong. Therefore bullets that share sub-class characteristics have been fired in rifles made within a relatively short period of time of each other by the same manufacturer using the same tool or tools. Therefore using sub-class characteristics, it cannot be said that the bullets were fired in the same rifle, because some consecutively manufactured rifles may share the same sub-class characteristics. Some sub-class features have been observed within the groove impressions and these result from 'carry-over' from one barrel to the next of striae created by the groove-producing tool. As a result, the firearms examiner places emphasis on the correspondence observed within land impressions rather than groove impressions.

Theory of firearms identification

Some aspects of the theory of firearms identification are contained in Appendix 4. There are currently two main schools of thought regarding the determination of a conclusion that a rifle definitely fired a bullet.

One methodology of firearms identification relies on the subjective interpretation of the observed correspondence, based on the examiner's experience and training in recognising the significance of sufficient agreement of corresponding striae, versus the low significance attached to fortuitous correspondence of a few corresponding striae. The sufficiency of agreement relates to the quantity and quality of correspondence, usually over many of the land and groove impressions. This is most probably the approach that would have been adopted in the 1970s.

The other common methodology undergoes the same comparison process, but the observed correspondence is supported by an objective measure of the number of consecutive striae that are observed to correspond between test-fired and recovered bullets (i.e. a count is made of the Consecutively Matching Striae, which is referred to as CMS). Two bullets may be determined as having been fired in the same rifle when the number of consecutively corresponding striae exceeds a critical threshold. The conservative criteria for consecutively matching striae have been established from an extensive analysis of known match and known non-match comparisons of land and groove impressions in fired bullets. This approach is unlikely to have been adopted in the 1970s.

A less widely adopted methodology is based on a subjective Bayesian assessment of the correspondence observed. This approach is particularly useful for comparisons where it cannot be conclusively determined that a bullet was fired in a particular rifle. A subjective assessment is made of two competing hypotheses – an assessment is made regarding the probability of obtaining the observed correspondence given that the recovered bullet was fired in the rifle and an assessment is made regarding the probability of obtaining the observed correspondence given that the recovered bullet was not fired in the rifle. The ratio of these two probabilities is known as the Likelihood Ratio (LR). The greater the value for the LR, the greater the weight is for supporting the proposition that the rifle had fired the recovered bullet. Since this is a subjective assessment, actual numbers for the LR are not estimated, but it can be useful to consider this framework to place the weight of the evidence observed on a scale of evidence strength for either one of two competing hypotheses. For example, a correspondence of class characteristics but no correspondence of corresponding striae and a large number of non-corresponding striae could give some level of support (perhaps providing slight support or

moderate support) for the proposition that the rifle did not fire the bullet. Conversely, many corresponding striae with few non-corresponding striae could provide strong or very strong support for the proposition that the rifle did fire the bullet.

Notations on the Polaroid Photographs taken by Mr Price.

There were twenty-three different photographs. All except two photographs depict comparisons between two fired bullets.

The comparison photographs would have been taken using a setup similar to that shown in Figure 2, which shows the comparison microscope used at DSIR by Dr Nelson and Mr Shanahan in Auckland in the 1970s.

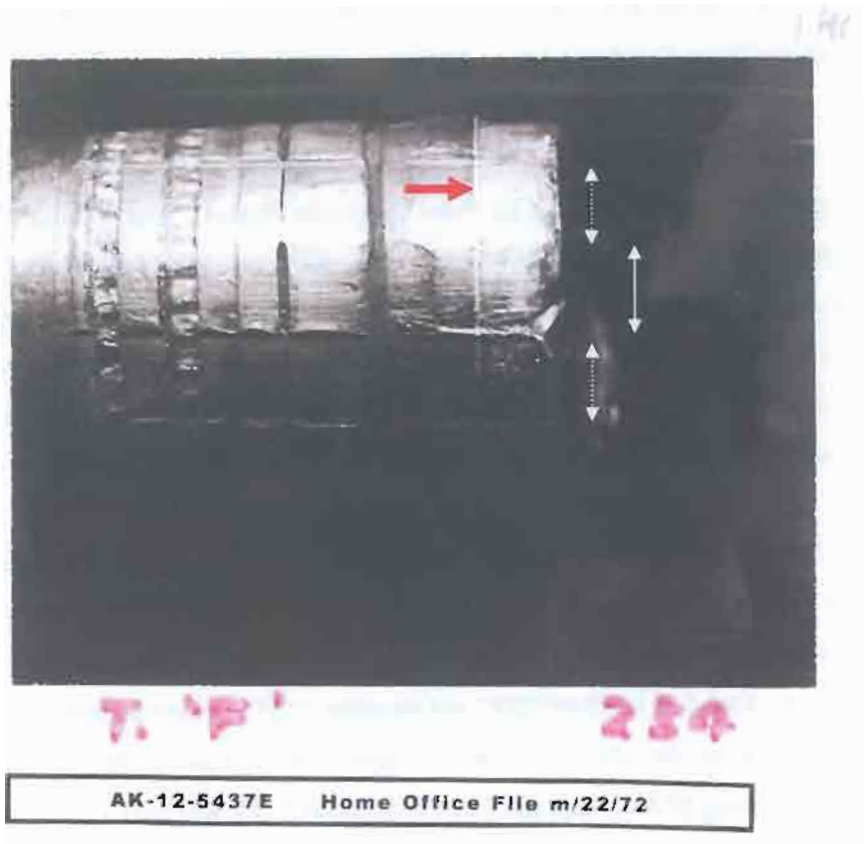


Figure 5. Polaroid photograph of a comparison between bullet "TF" (left) and bullet "234" (right). The red arrow indicates the faint line or division between the images of each bullet on the microscope stages A and B. The dashed double-arrowed lines indicate the width of the land impressions. The bold double-arrowed line indicates the width of the groove impression.

The comparison photographs show a faint vertical line down each photograph (e.g. see Figure 5). The faint vertical line is the edge between the images of each bullet on stages A and B. Therefore, the image to the left of the faint line in Figure 5 is the bullet that has been mounted on one stage and the image to the right of the faint line is the bullet that has been mounted on the other stage.

The photograph of the bullet comparison has been taken with the groove and land impressions of each bullet aligned so that they are continuous across the diving line between the two images. This allows the registering of lands and grooves so that any correspondence of striae can be determined.

It appears that Mr Price has annotated the photograph using a pink pen. Other photographs have similar or less annotations. My interpretation of his annotations is as follows:

1. In the top right corner of the Polaroid photograph is written "**1PSP**". I have been informed that "**PSP**" are the initials of Mr Peter Shepstone Prescott. The "**1**" appears to refer to a numbering system for the lands and grooves of the compared bullets. In the centre of the photograph is a groove impression and other photographs that have the annotation "**1PSP**" are of the same groove impression seen in the centre of the photograph (e.g. see Polaroid Photograph 2 in Appendix 3). Some photographs have no designation as to which land or groove is shown. The extent of designated land and groove numbers is from 1 to 3.

2. Underneath the photograph is written "**T. 'F' 234**". These will relate to the descriptors of the items being compared. One bullet is to the left ("**T. 'F'**") and the other bullet (**234**) being compared is to the right. There were two bullets of interest that were recovered from the Crewes. One was labelled "**234**" and the other "**289**". Of the 21 comparison photographs, 19 have "**234**" on the right side of the photograph and two have "**289**". Exhibit 234 was recovered from the body of Mrs Jeannette Crewe and exhibit 289 was recovered from the body of Mr Harvey Crewe. The bullet on the left is therefore a test-fired bullet. There are three different designations for the test-fired bullets:

a. **T. 'F'**;

b. **TEST N.Z. 'F'**; and

c. T.

In my opinion the bullets referred to as **T. 'F'** and **TEST N.Z. 'F'** are the same test-fired bullet, which is the one prepared by Dr Nelson i.e. item 01 (PET1489/1). My justification for this conclusion is given below.

3. To the left of the photograph there is the notation "**1 x10**". The "1" appears to relate again to the land or groove numbering designation, as other photographs have "**2**" or "**3**" and these correspond to the respective numbers in the top right corner of the Polaroid photographs (see #1 above). Other photographs have "**x20**" or "**x50**" and they correspond to views of greater magnification (see Polaroid Photographs 1, 2 and 4 in Appendix 3). Therefore these notations relate to the choice of objective lens (see Figure 2) which appears to be either 10x, 20x or 50x objective lenses. Other photographs have the additional notation such as "**(a)**" or "**(b)**". The letters '**a**' and '**b**' appear to relate to slightly different views that emphasise a different point.

Therefore the photograph in Figure 5 has been taken of the comparison between Dr Nelson's test-fired bullet (item 01 and referred to in the Report of the Royal Commission as "F") and exhibit 234 which was recovered from the body of Mrs Jeannette Crewe.

Examination of the Polaroid Photographs taken by Mr Price.

A description for each Polaroid photograph is given in Appendices 2 and 3. These descriptions have been determined from Mr Price's notations, together with comparisons of bullet features seen in the photographs or by comparison to the actual bullets submitted for examination.

Comparisons of Mr Price's test-fired bullet (item 3) with exhibit 234.

There were a series of Mr Price's photographs (Polaroid Photographs 11 to 19 in Appendix 3) that were annotated "T". To determine which bullet "T" was, I compared the various bullets submitted for examination with the Polaroid photographs. I compared the visible characteristics of features on the surface of the bullets with those features seen in the Polaroid photographs. These features are not the striae that are used for the discipline of Firearms Identification, but are merely indentations or discolorations on the surface of the bullets that have very identifiable shape and position.

Polaroid Photograph 17

Polaroid Photograph 18

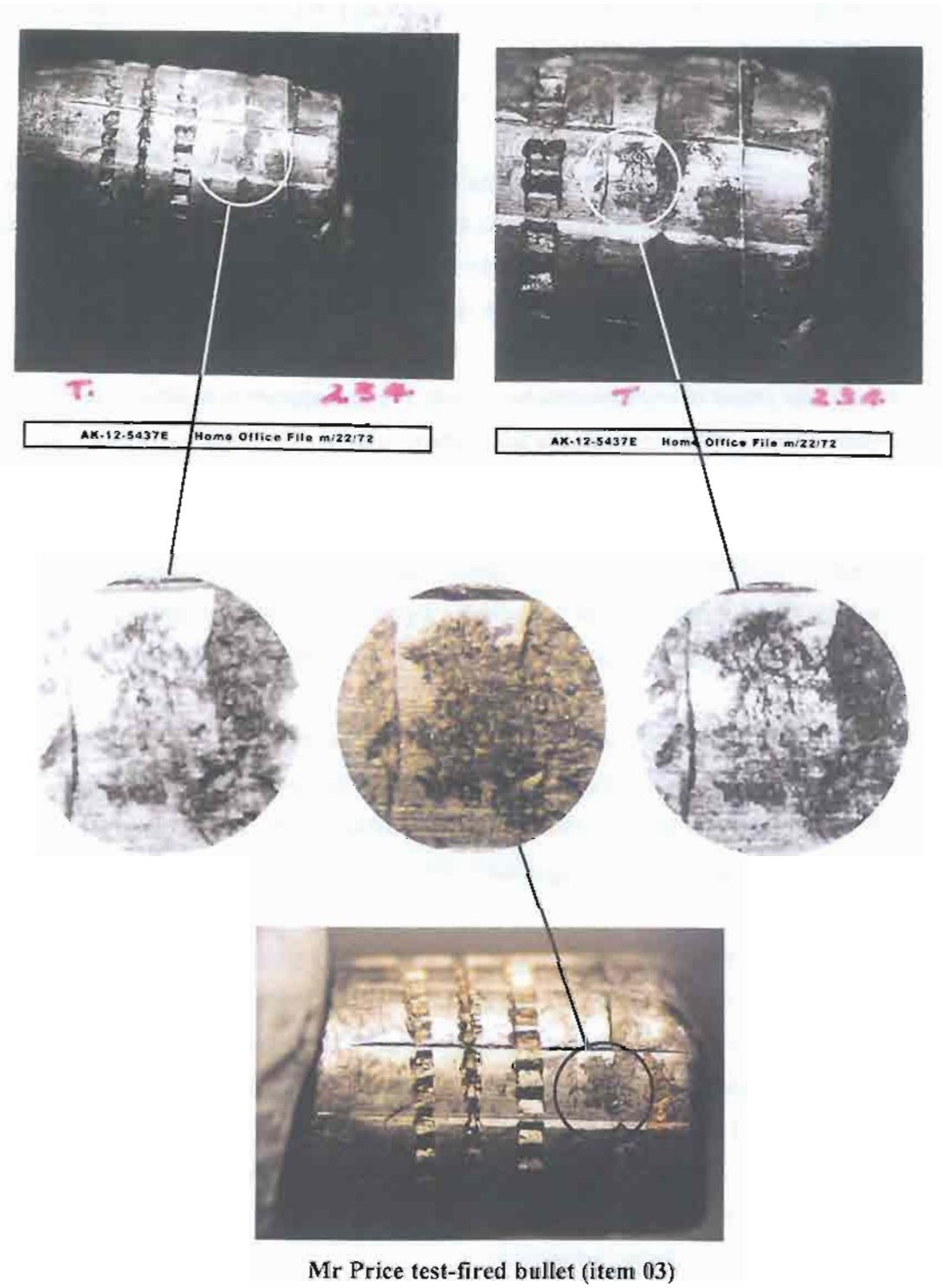


Figure 6. Comparison of features of Test T and Mr Price's test-fired bullet. "Land Impression 2"

Figure 6 shows the correlation observed between surface features of Mr Price's test-fired bullet (item 3) and Polaroid Photographs 17 and 18. The annotation on Polaroid Photograph 17 describes this land impression as #2 (i.e. "2PSP"). Further examination and comparison showed that Polaroid Photograph 19 also depicts the land impression shown in Photograph 17.

The Polaroid Photograph 13 shown in Figure 7 shows the correlation observed between surface features of Mr Price's test-fired bullet (item 3) and Polaroid Photograph 13. The annotation on Polaroid Photograph 13 describes this groove impression as #1 (i.e. "1PSP").

The land impression immediately above this groove impression is the one shown in Figure 6.

Further examination and comparison showed that Polaroid Photograph 16 also depicts the groove impression shown in Photograph 13.

The Polaroid Photograph 11 shown in Figure 8 shows the correlation observed between surface features of Mr Price's test-fired bullet (item 3) and Polaroid Photograph 11. There was no annotation on Polaroid Photograph 11. I have described this land impression as #0.

The groove impression immediately above this land impression is the one shown in Figure 7.

Further examination and comparison showed that Polaroid Photograph 12 also depicts the land impression shown in Polaroid Photograph 11.

Polaroid Photograph 13 Mr Price test-fired bullet (item 03)

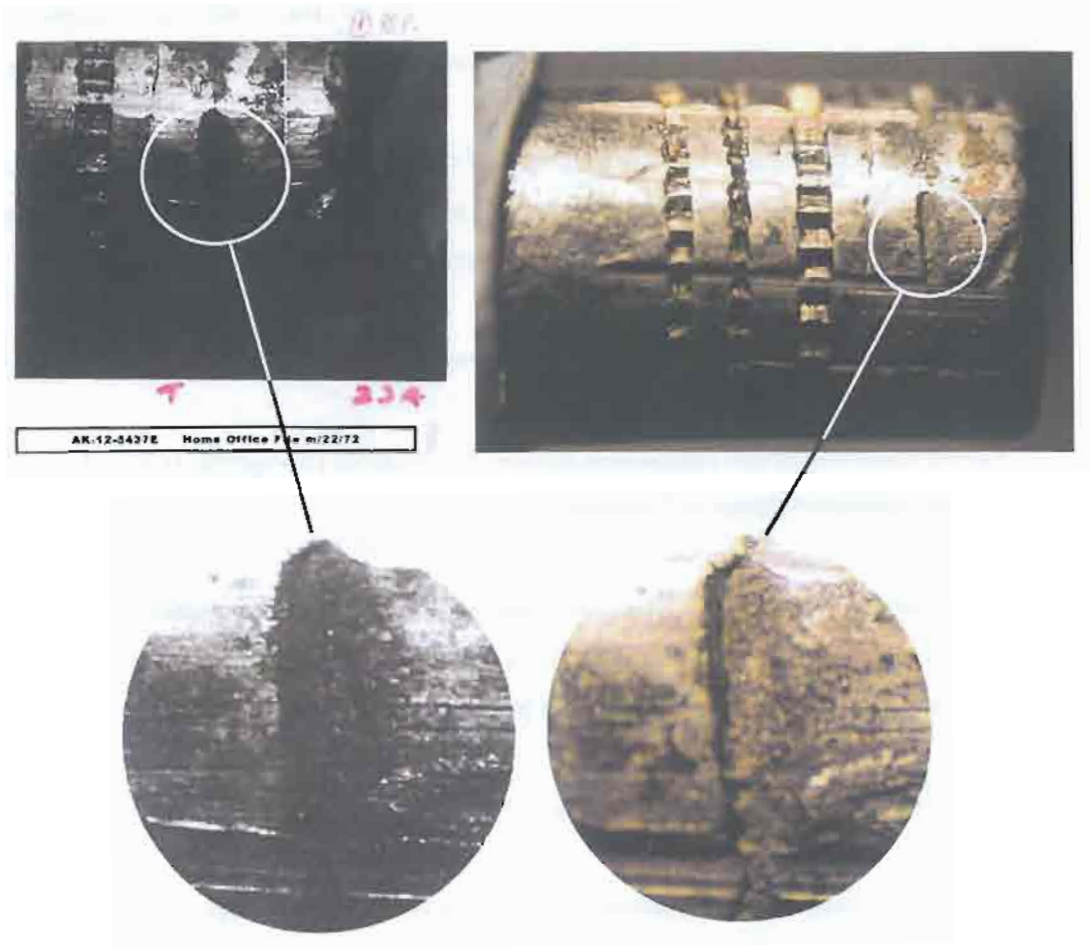


Figure 7. Comparison of features of Test T and Mr Price's test-fired bullet. "Groove Impression 1"

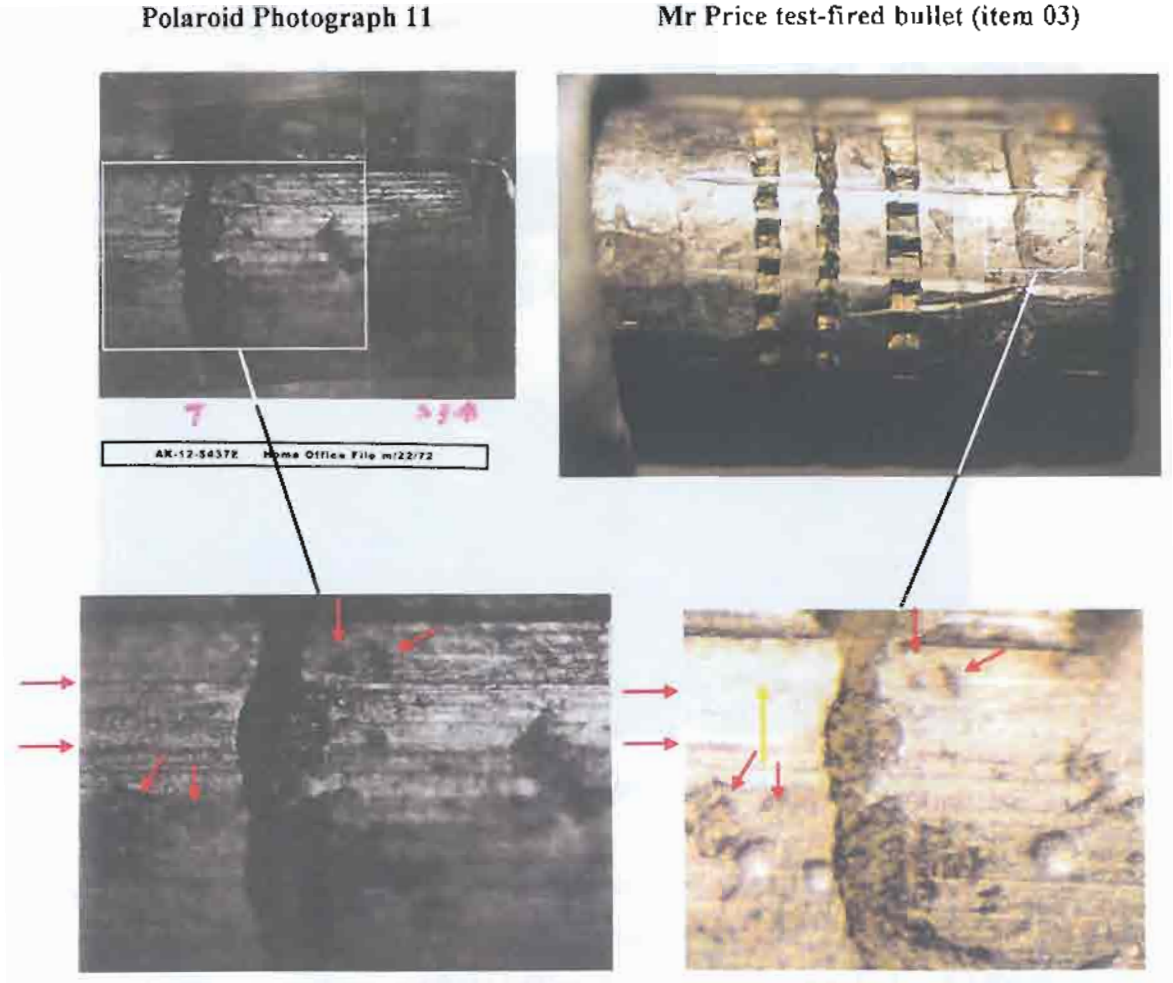


Figure 8. Comparison of features of Test T and Mr Price's test-fired bullet. "Land Impression 0"

Summary of the comparisons of Mr Price's test-fired bullet (item 3) with exhibit 234.

There were nine photographs taken by Mr Price that were annotated "T" (Polaroid Photographs 11 to 19 in Appendix 3). These were of two land impressions and one groove impression that were consecutive. These impressions (0, 1 and 2) are shown together in Figures 9, 10 and 11.

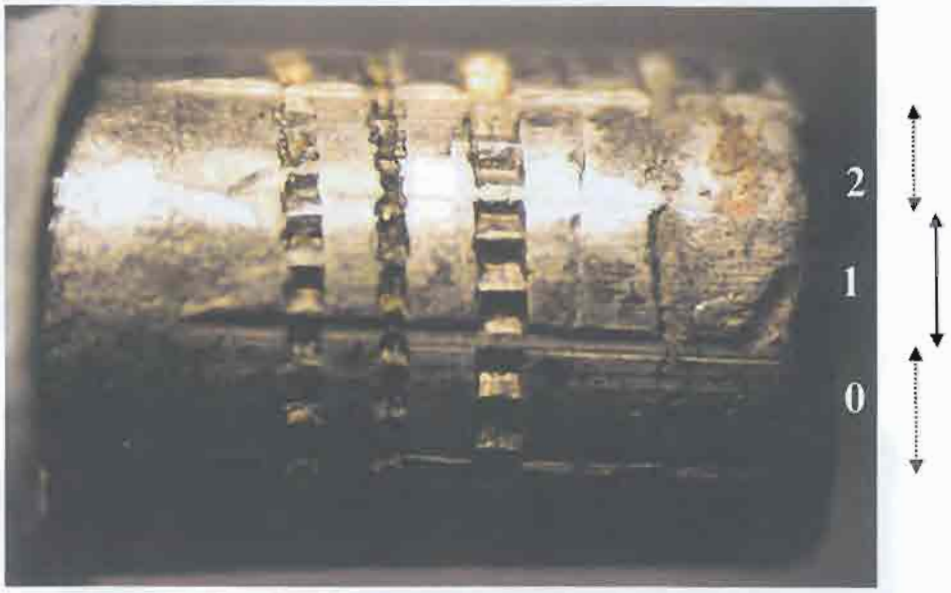


Figure 9. Photograph of the bullet test fired by Mr Price (item 03).

Figure 11 shows examples of the Polaroid photographs of microscope comparisons between the bullet test fired by Mr Price (item 03) and exhibit 234 (recovered from the body of Mrs Jeannette Crewe). I have arrowed those striae that Mr Price may have considered demonstrated correspondence between the two bullets. This is a difficult determination to be made from simply viewing photographs that were probably simply taken as an aide-memoire by Mr Price. Other examiners may place more or less significance on these apparent correspondences. I have also indicated apparent non-corresponding striae. The clarity of these photographs is not good and there may be more or less correlation observed by Mr Price that cannot be clearly demonstrated in the photographs. At best, Figure 11 might show perhaps two sets of two and one set of three consecutively matching striae. This would fall below the conservative quantitative criteria for identification as expressed in terms of CMS theory (see Appendix 4).

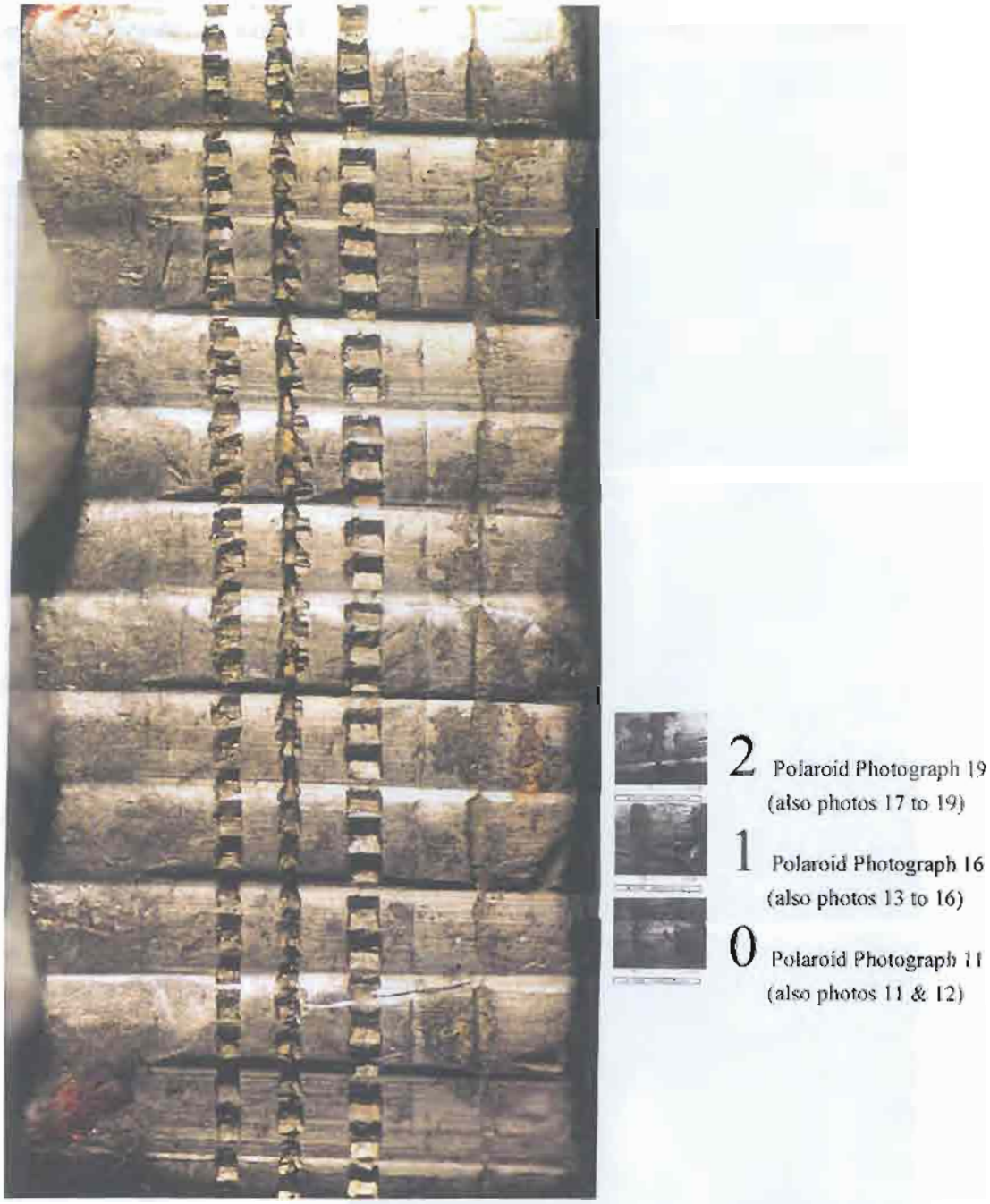
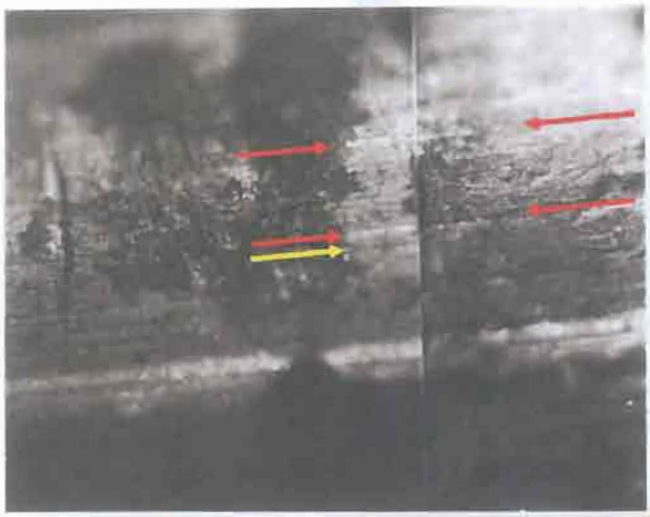
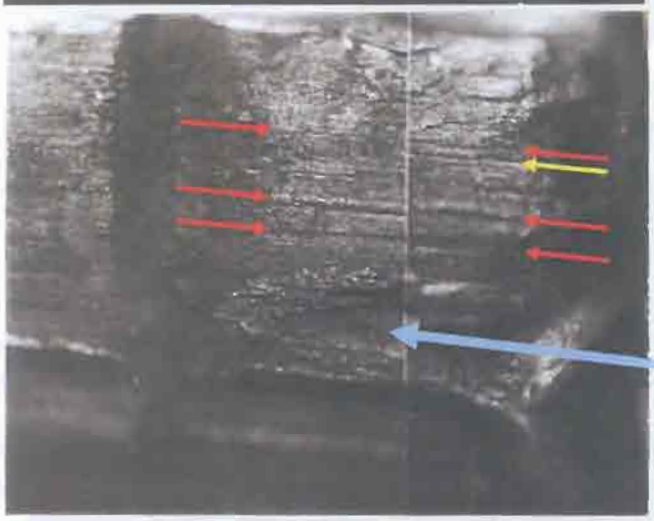


Figure 10. Montage of photographs of the land and groove impressions of the bullet test fired by Mr Price (item 03) alongside the corresponding Polaroid photographs of microscope comparisons with exhibit 234 which was recovered from the body of Mrs Jeannette Crewe. See enlargements of the Polaroid photographs in Figure 11.





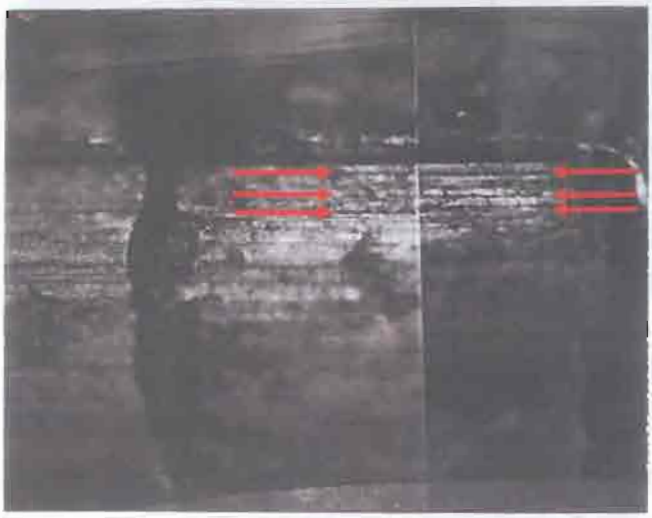


Figure 11. **Polaroid photographs of microscope comparisons between the bullet test on the left, fired by Mr Price (item 03), and exhibit 234 on the right, which was recovered from the body of Mrs Jeannette Crewe.** The red arrows indicate examples of corresponding striae. The yellow arrows indicate examples of non-corresponding striae.

2 **Polaroid Photograph 19**
(also see photographs 17 to 19)

1 **Polaroid Photograph 16**
(also see photographs 13 to 16)

Gas erosion near the base of the bullet

0 **Polaroid Photograph 11**
(also see photographs 11 & 12)

However the quality of correspondence shown in Polaroid Photographs 11, 16 and 19 (seen in Figure 11) is low and therefore a conservative determination regarding whether or not Mr A. Thomas' rifle fired exhibit 234 would be appropriate.

As reported in the Report of the Royal Commission of Enquiry into this matter, Mr Price's major conclusion, "as stated in a written report dated 2 August 1972 was: "I have microscopically examined the bullet (referring to the Jeannette Crewe fatal bullet). Although I have been unable to establish conclusively whether or not it was fired in the rifle exhibit 317, the limited individual bore characteristics it shows indicate that it could well have been fired in this rifle" [paragraph 230].

Also, it was reported that Mr Prescott examined the photographs on the laboratory file, and the bullets test fired by Mr Price in 1972 and the major conclusion of Mr Prescott's written statement, dated 30 September 1980, was that "I have formed the opinion that it is highly probable that the rifle (317) fired the bullet (234) (i.e. from Jeannette Crewe)" [paragraph 231].

Therefore neither Mr Price nor Mr Prescott have conclusively identified exhibit 234 as having been fired in Mr A. Thomas' rifle, but clearly they have recognised corresponding striae that support the proposition that the rifle could have fired the bullet.

I have considered the significance of the correspondence of microscopic striae observed in Figure 11 and other Polaroid photographs. There is some correspondence of the general form and location of gas erosion near the base of the bullet (e.g. see Figure 11). For two land impressions and one groove impression there has been illustrated, in Mr Price's Polaroid photographs, some correspondence within the striae (Figure 11 and, for example, Polaroid Photographs 11, 16 and 19). In my opinion, the correspondence is not overwhelming, with relatively few corresponding striae. Although there are relatively few striae in total seen in the land and groove impressions, a significant proportion of these show some correspondence between the bullets. i.e. there do not appear to be many non-corresponding striae.

In Polaroid Photograph 19 I have labelled two corresponding striae and one non-corresponding striation. In Polaroid Photograph 16 I have labelled three corresponding striae and one non-corresponding striation. In Polaroid Photograph 11 I have labelled three corresponding striae.

Within each photograph there may be other corresponding striae and other non-corresponding striae, but the quality of the photographs does not allow interpretation of these. Some of the areas appear out of focus or unclear. In my opinion it is significant that there are apparent corresponding striae without significant numbers of striae that do not correspond.

In my opinion the Bayesian framework is the best approach to assess the significance of the comparison between the bullet test fired in Mr Arthur Thomas' rifle and exhibit 234 (see Appendix 4). In assessing this significance, I have considered the following factors;

- the widths of the land and groove impressions are the same;
- there is some correspondence of the location of gas erosion on the base of the bullets;
- three land or groove impressions of a total of twelve impression on the test-fired bullet have shown some correspondence of striae;
- there are corresponding striae within the three land or groove impressions with a low proportion of non-corresponding striae; and
- the quality of some of the correspondences observed is not good.

In interpreting this comparison I have considered two opposing hypotheses; one hypothesis is that the bullet exhibit 234 was fired in Mr Arthur Thomas' rifle. The other hypothesis is that the bullet exhibit 234 was not fired in Mr Arthur Thomas' rifle.

In my opinion, the probability of observing the correspondences noted above, between the bullet exhibit 234 and bullets test fired in Mr Arthur Thomas' rifle, is high if that rifle fired the bullet. Conversely, the probability of observing the correspondences noted above for a bullet that was fired in another similar calibre rifle is very low.

Therefore in my opinion, the observed correspondence provides strong support for the proposition that the bullet exhibit 234 had been fired in the rifle submitted for examination.

I have chosen the term "strong support" from the following range of conclusions; neutral, slight support, moderate support, strong support, very strong support, extremely strong support and conclusive (see Appendix 4).

Comparisons of Mr D. Nelson's test-fired bullet (F, item 01) with exhibit 234.

There were a series of Mr Price's photographs (Polaroid Photographs 1 to 10, 20, 21 and 23 in Appendix 3) that were annotated "**T F**" (photographs 1 to 10), "**TEST NZ F**" (photographs 20 and 21) or "**TEST**" (photograph 23).

To determine which bullet these annotations referred to, I compared the various bullets submitted for examination with the Polaroid photographs. I compared the visible characteristics of features such as indentations or discolorations on the surface of the bullets with those features seen in the Polaroid photographs.

Figure 12 shows the correlation observed between surface features of Dr Nelson's test-fired bullet (item 01) and Polaroid Photograph 20. Therefore the bullet described as "**TEST NZ F**" is the bullet test-fired by Dr Nelson in Mr A. Thomas' rifle. There was no annotation on Polaroid Photograph 20 that describes which land impression the photograph is of, but there is a very clear 'score' in the land impression and this is almost certainly that described in the Report of the Royal Commission of Enquiry into this matter as the one on which Dr Nelson "found a heavy score mark" [paragraph 224].

Figure 13 shows the correlation observed between surface features of Dr Nelson's test-fired bullet (item 01) and Polaroid Photograph 9. Therefore the bullet described as "**T F**" is the bullet test-fired by Dr Nelson in Mr A. Thomas' rifle. The annotation on Polaroid Photograph 9 describes this groove impression as #3 (i.e. "3PSP"). Further examination and comparison showed that Polaroid Photograph 10 also depicts the groove impression shown in Photograph 9.

There were some significant dissimilarities observed between Photograph 9 and Dr Nelson's test-fired bullet (item 01). In my opinion these dissimilarities are the result of alteration of the lead surface through repeated striking of the bullet against the glass vial that it was contained in. For example the heel of the bullet was significantly rounded inwards

Figure 14 shows the correlation observed between surface features of Dr Nelson's test-fired bullet (item 01) and Polaroid Photograph 6. The annotation on Polaroid Photograph 6 describes this land impression as #2 (i.e. "2PSP"). Further examination and comparison

showed that Polaroid Photographs 7 and 8 also depict the land impression shown in Photograph 6.

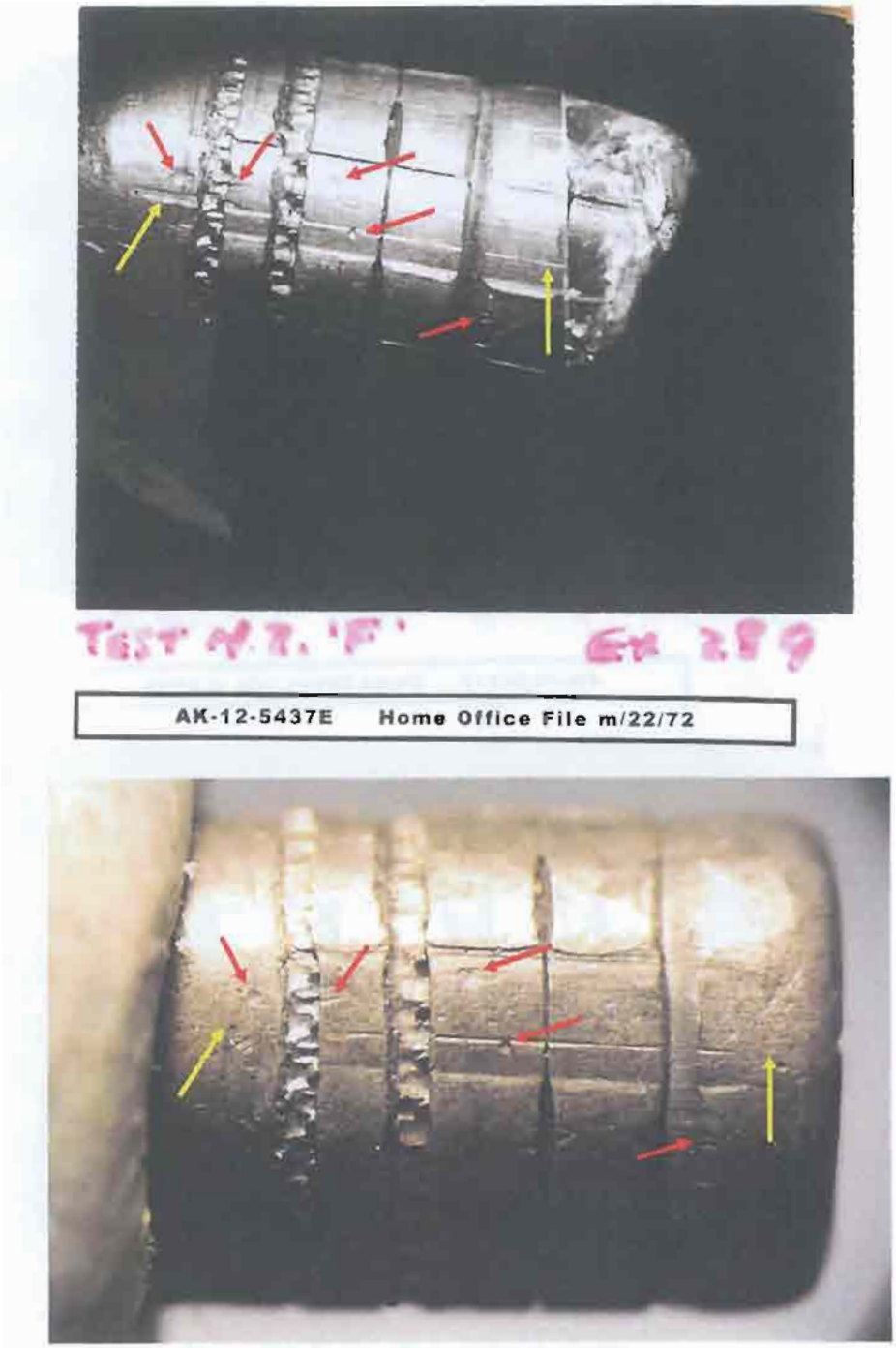
Figure 15 shows the correlation observed between surface features of Dr Nelson's test-fired bullet (item 01) and Polaroid Photograph 1. The annotation on Polaroid Photograph 1 describes this groove impression as #1 (i.e. "1PSP"). Further examination and comparison showed that Polaroid Photographs 2 to 5 also depict the groove impression shown in Polaroid Photograph 1.

Figures 16 and 17 show the relationship between the lands and grooves of Dr Nelson's test-fired bullet (item 01) and of the same bullet shown in Polaroid Photograph 24. Of particular significance is that groove impression #3 is out of sequence with land impression #2 and groove impression #1. Compared to Figure 18, which shows Exhibit 234 overlaid with relevant portions of the Polaroid photograph comparisons, groove impression #3 is not in sequence. In my opinion, this means that this particular comparison of groove impression #3 between exhibit 234 and Dr Nelson's test-fired bullet (item 01) is erroneous.

Figure 19 shows examples of the Polaroid photographs of microscope comparisons between the bullet test fired by Dr Nelson (item 01) and exhibit 234 (recovered from the body of Mrs Jeannette Crewe). I have arrowed those striae that show correspondence between the two bullets, as well as non-corresponding striae. The clarity of these photographs is not good and there may be more or less correlation observed by Mr Price that cannot be clearly demonstrated in the photographs. At best, Figure 19 might show perhaps a set of three and a set of two consecutively corresponding striae. This would fall below the conservative quantitative criteria for identification as expressed in terms of CMS theory.

However the quality of correspondence shown in Polaroid Photographs 3, 6 and 10 (seen in Figure 19) is low and therefore a conservative determination regarding whether or not Mr A. Thomas' rifle fired exhibit 234 would be appropriate. Given the juxtaposition of groove impression #3 in the sequence of "matching" lands and grooves, there must be considerable doubt as to the veracity of the comparisons observed.

Polaroid Photograph 20



Dr Nelson's test-fired bullet (item 01)

Figure 12. **Comparison of features of "Test NZ 'F'" and Dr Nelson's test-fired bullet.**
The red arrows indicate similarities. The yellow arrows indicate dissimilarities.

Polaroid Photograph 9

Dr Nelson's test-fired bullet (item 01)

Figure 13. **Comparison of features of "Test NZ 'F'" and Dr Nelson's test-fired bullet. "Groove Impression 3"**

The red arrows indicate similarities. The yellow arrows indicate dissimilarities.

Polaroid Photograph 6

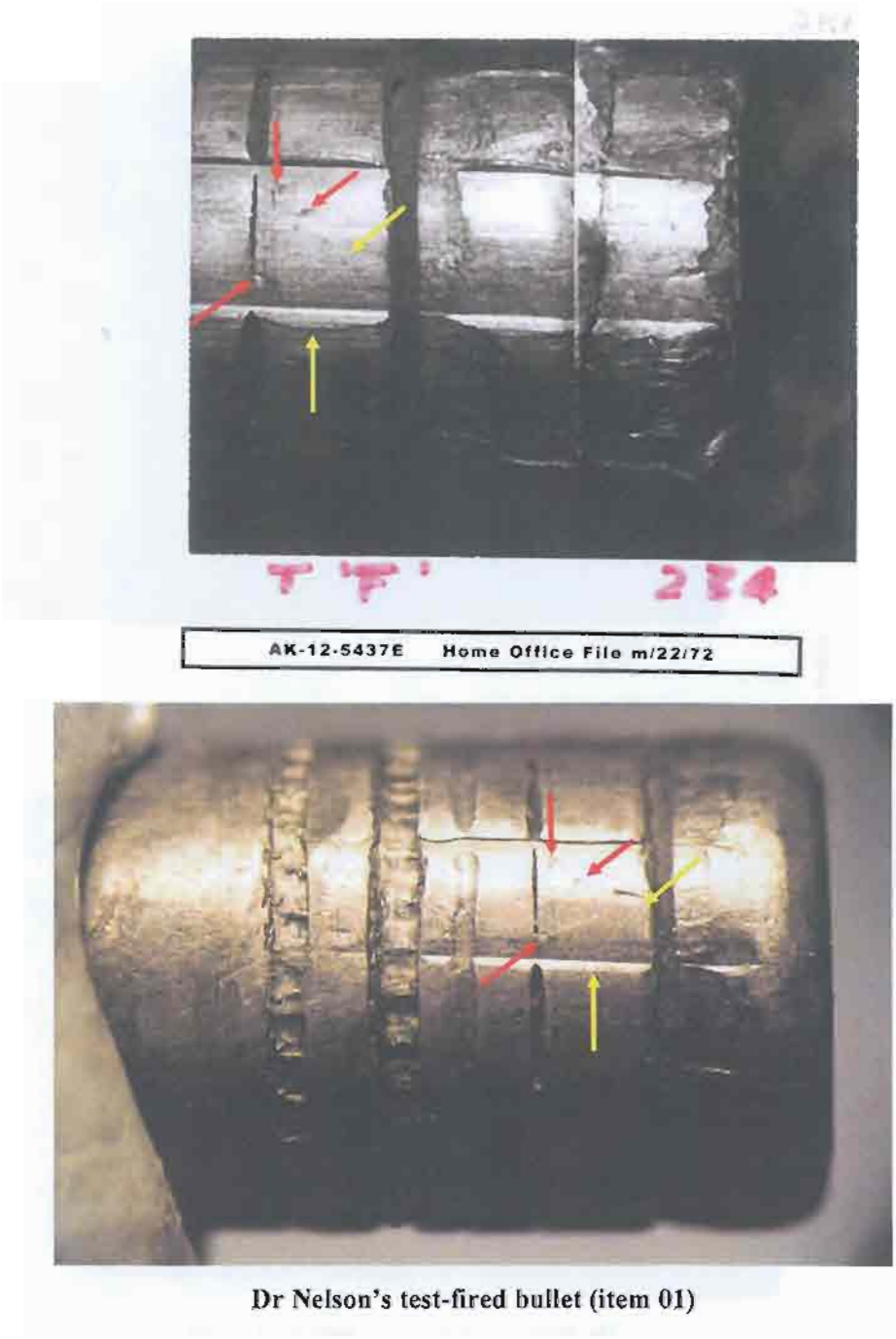


Figure 14. Comparison of features of "T 'F'" and Dr Nelson's test-fired bullet. "Land Impression 2"
The red arrows indicate similarities. The yellow arrows indicate dissimilarities.

Polaroid Photograph 1

Dr Nelson's test-fired bullet (item 01)

Figure 15. Comparison of features of "T 'F'" and Dr Nelson's test-fired bullet. **"Groove Impression 1"**
The red arrows indicate similarities. The yellow arrows indicate dissimilarities.

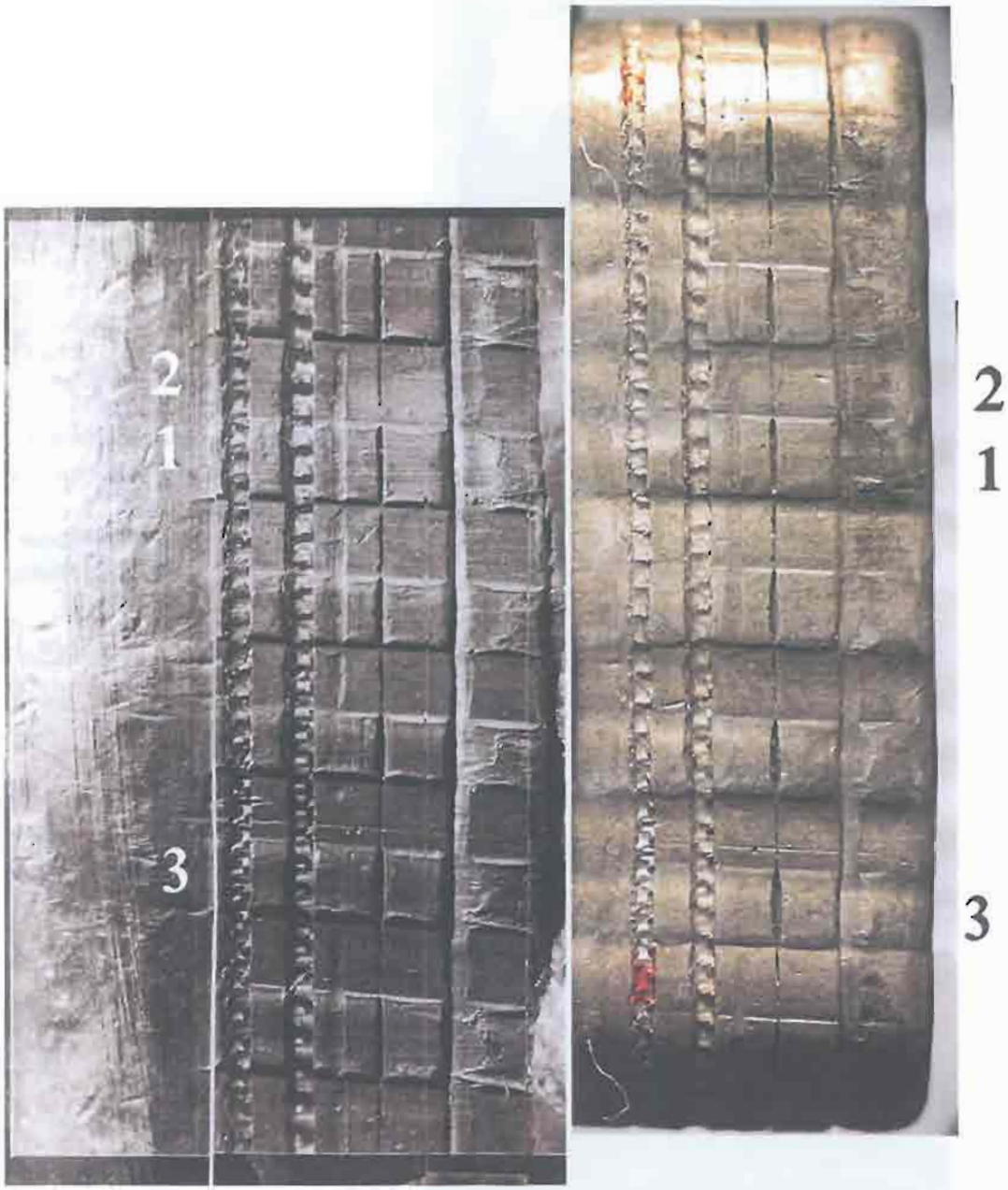


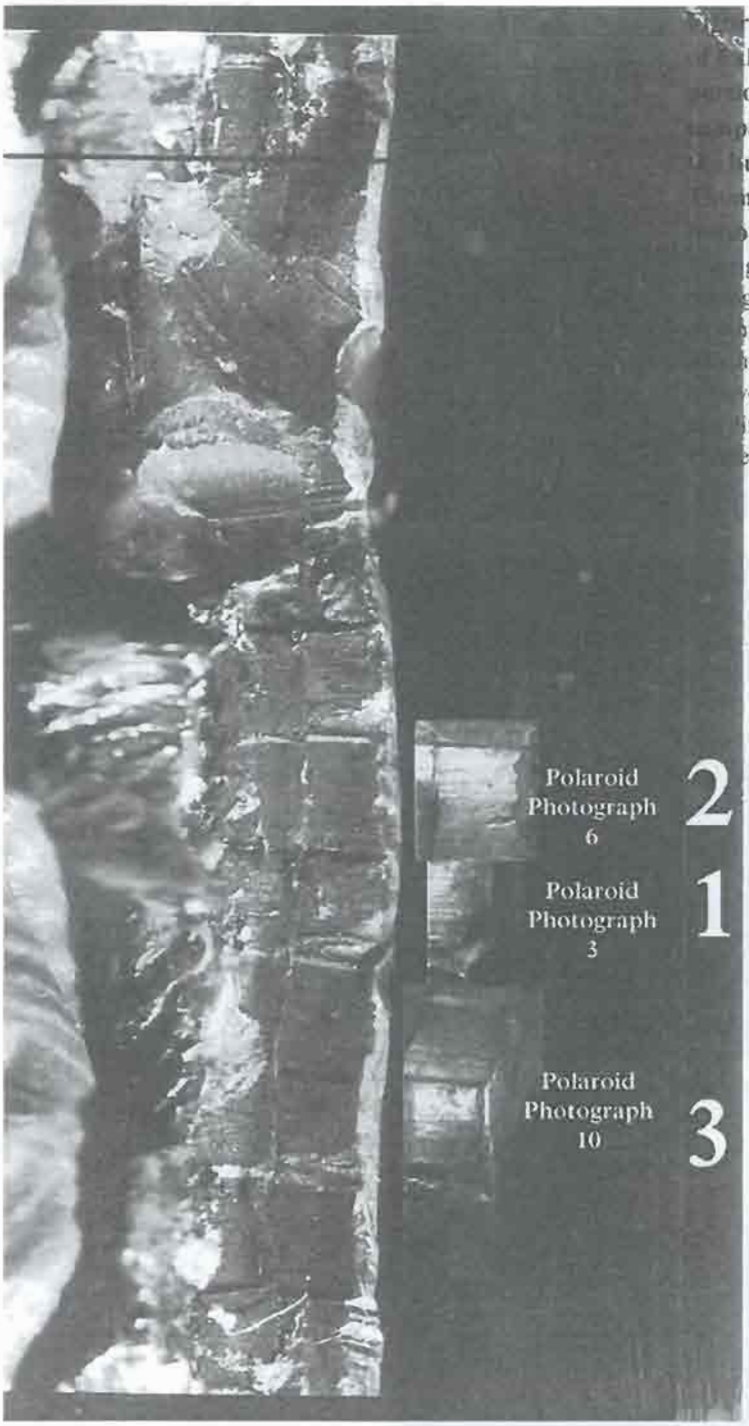
Figure 16. Comparison of Polaroid Photograph 24, taken by Mr Price of the bullet test fired in Mr A. Thomas' rifle by Dr Nelson, with Dr Nelson's test-fired bullet (item 01).

2 Polaroid Photograph 6
(also Polaroid Photographs 7 & 8)

1 Polaroid Photograph 3
(also Polaroid Photographs 1, 2, 4 & 5)

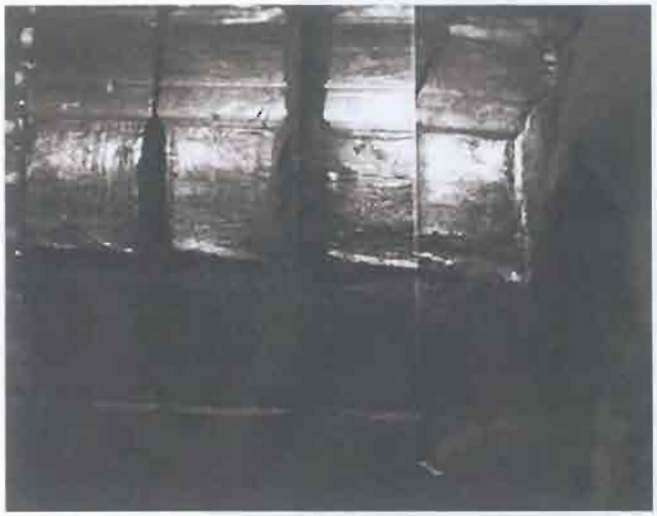
3 Polaroid Photograph 10
(also Photograph 9)

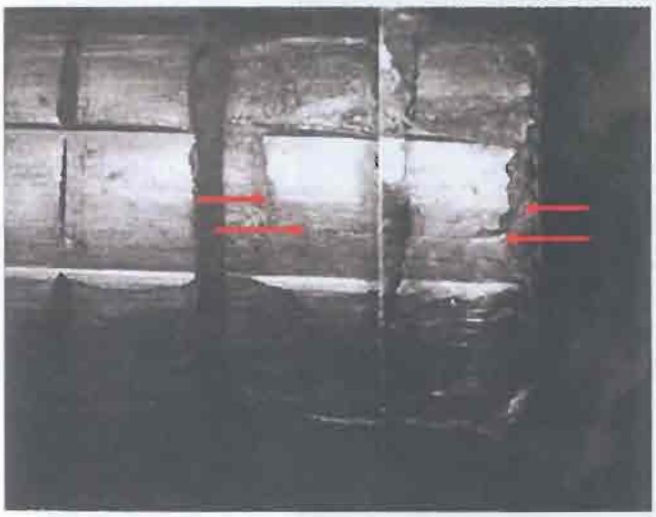
Figure 17. Montage of photographs of the land and groove impressions of the bullet test fired by Mr Price (item 03) alongside the corresponding Polaroid photographs of microscope comparisons with exhibit 234 which was recovered from the body of Mrs Jeannette Crewe. See enlargements of the Polaroid photographs in Figure 19.



re 18. The Polaroid Photograph hibit 234 overlaid with relevant ons of the Polaroid photograph parisons taken by Mr Price of ullet test fired in Mr A. nas' rifle by Dr Nelson, with Dr n's test-fired bullet (item 01).

ght side of the comparison graph which shows the relevant area ibit 234, has been selected and pasted e photograph of exhibit 234. The e position of groove impression #3 is fferent location to that shown in 16.





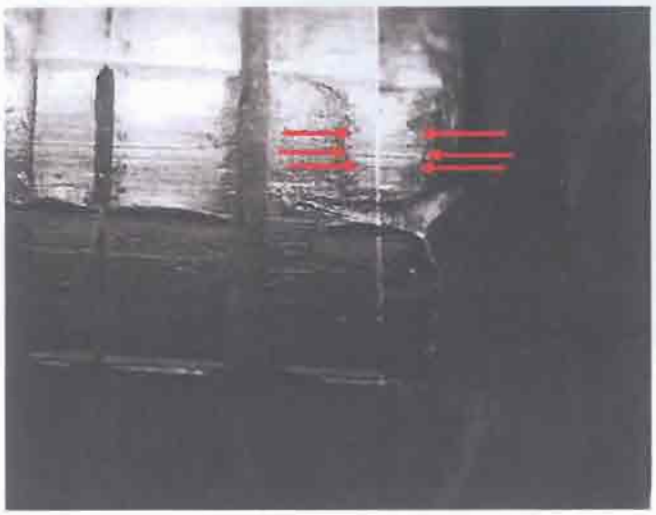


Figure 19. Polaroid photographs of microscope comparisons between the bullet test fired by Dr Nelson (item 01) and exhibit 234, which was recovered from the body of Mrs Jeannette Crewe. The red arrows indicate examples of corresponding striae. The yellow arrows indicate examples of non-corresponding striae.

3 Polaroid Photo 10
(also see photograph 9)

2 Polaroid Photo 6
(also see photographs 7 & 8)

1 Polaroid Photo 3
(also see photographs 1,2,4 &5)

Are the land and groove impressions labelled by Mr Price the same for each test-fired comparison?

Mr Price took Polaroid photographs for three sets of comparisons; F vs 234; T vs 234; and F vs 289 (where F is Dr Nelson's test-fired bullet and T is Mr Price's test-fired bullet).

For the comparison of F vs 234, Mr Price annotated three different land and groove comparisons, described as 1, 2 and 3.

For the comparison of T vs 234, Mr Price annotated two different land and groove comparisons, described as 1 and 2, and he photographed another comparison without annotation, which I have labelled as "0".

The groove impressions described as "1" for both comparisons F vs 234 and T vs 234 refer to the same groove impression of exhibit 234. This can be seen in Figure 20.

The land impressions described as "2" for both comparisons F vs 234 and T vs 234 refer to the same land impression of exhibit 234. This can be seen in Figure 21.

The groove impression described as "3" for comparison F vs 234 had no counterpart in the comparison of T vs 234. The groove impression, described as "3", of exhibit 234 is shown in Figure 22.

For the comparison of T vs 234, there was a land impression that was not annotated by Mr Price, but which I have described as "0". This is shown in Figure 8. As can be seen in Figure 9 and 10, this land impression "0" immediately precedes groove impression 1 and land impression 2. This land impression of exhibit 234 is shown in Figure 22. However the only Polaroid photographs taken of land impression "0" have been taken at 50x magnification.

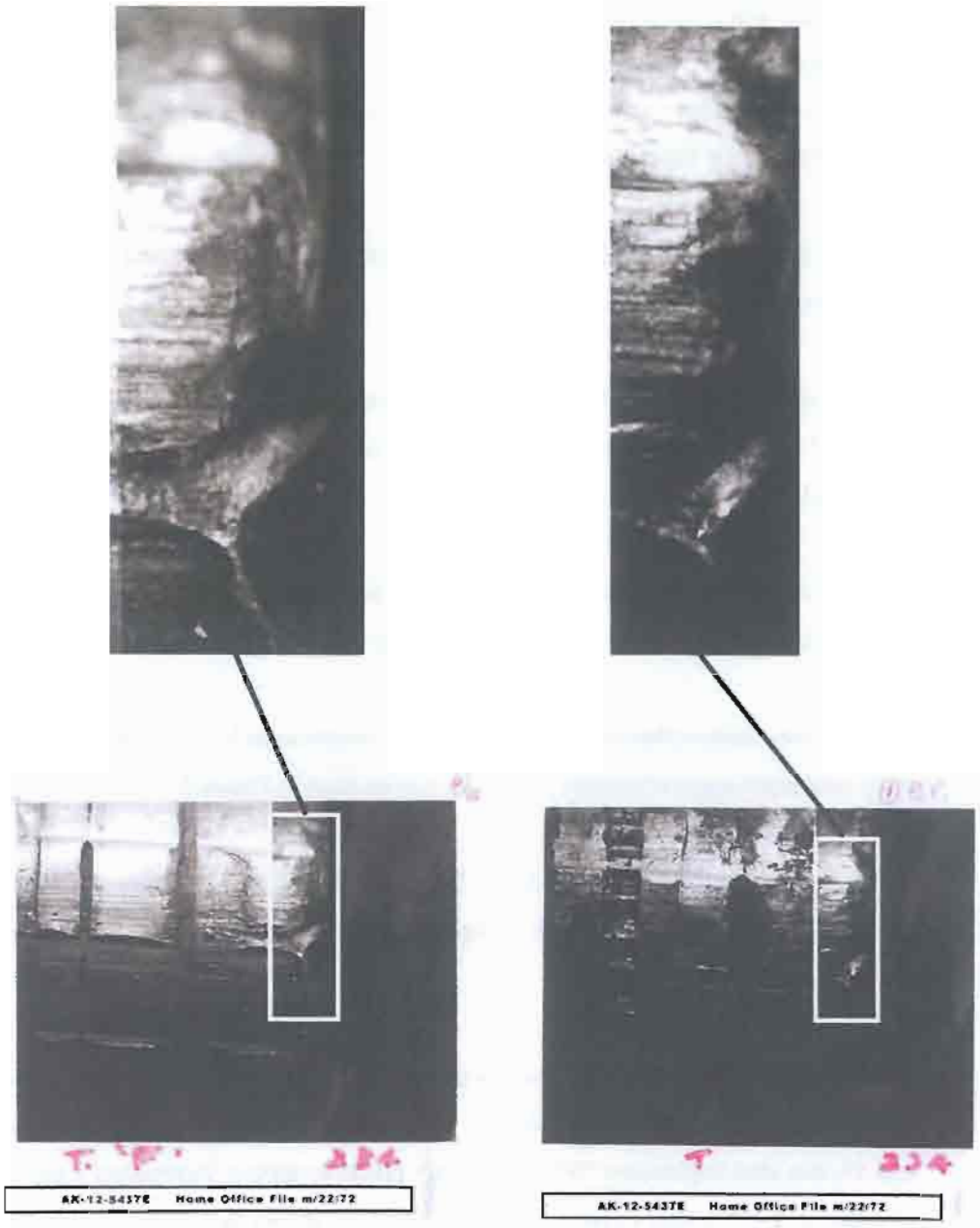


Figure 20. Comparison of features of "Groove Impression 1" of exhibit 234 for the comparisons F vs 234 and T vs 234. On the left is Polaroid Photograph 3 and on the right is Polaroid Photograph 13.

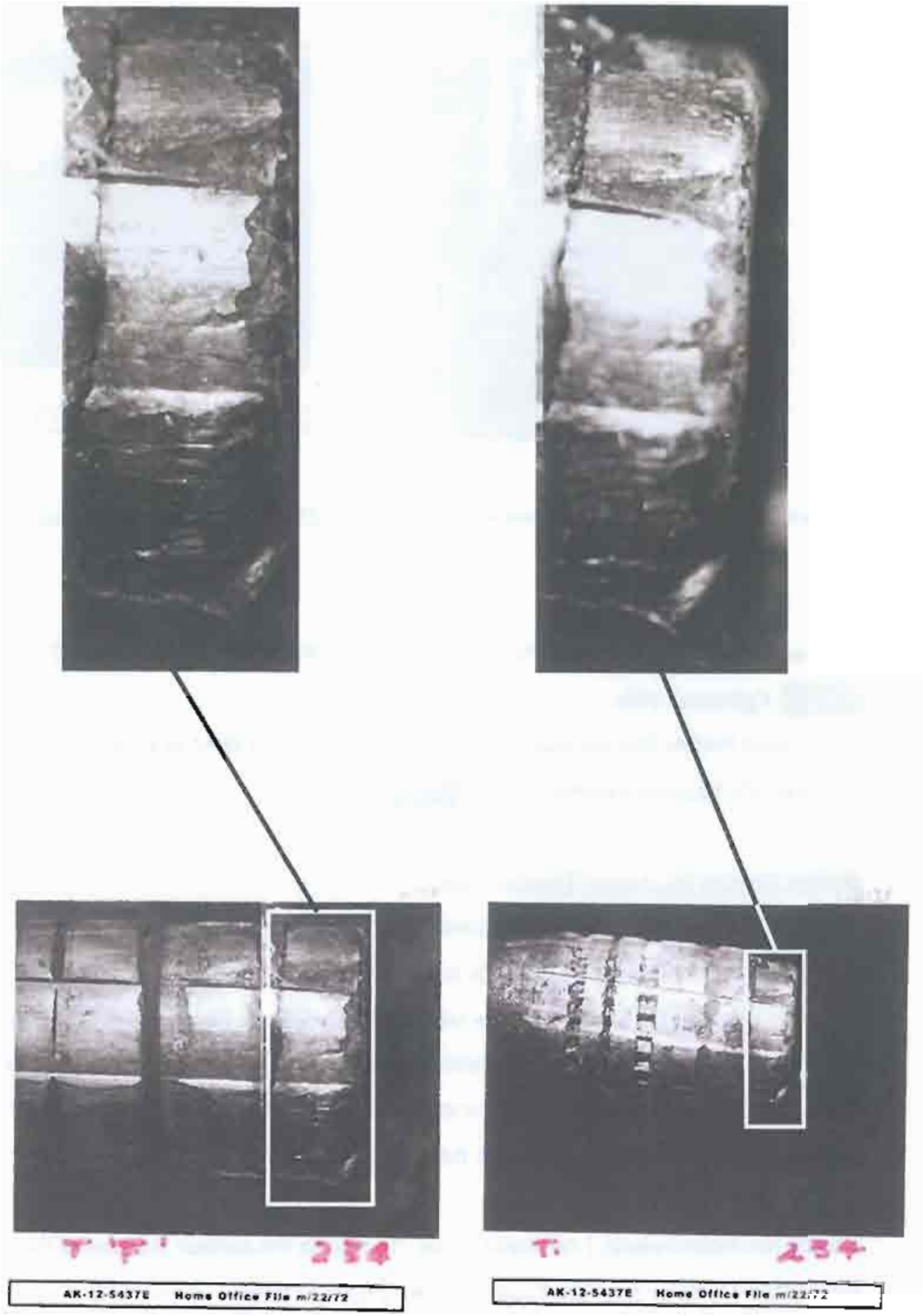


Figure 21. Comparison of features of "Land Impression 2" of exhibit 234 for the comparisons F vs 234 and T vs 234. On the left is Polaroid Photograph 6 and on the right is Polaroid Photograph 17.

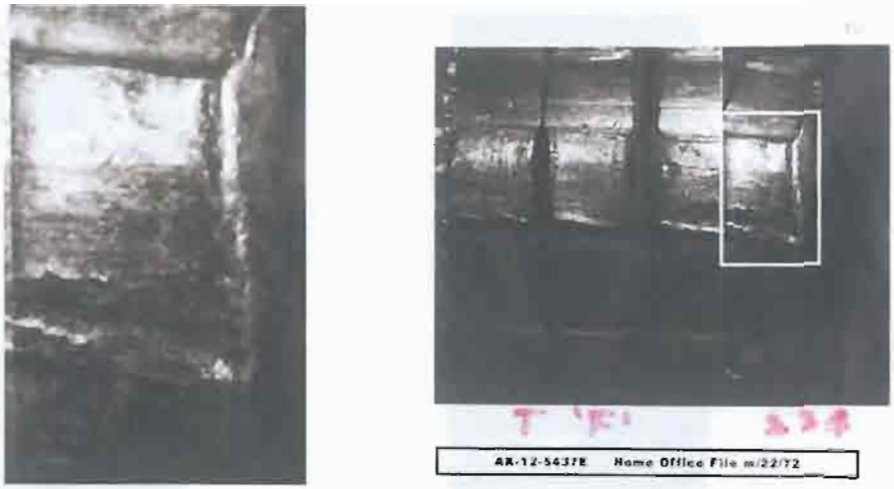


Figure 22. "Groove Impression 3" of exhibit 234. (Polaroid Photograph 10)

Comparison of Bullets Test Fired in Mr Arthur Thomas', Mr Richard Thomas' and Mr [redacted] Eglinton' rifle.

I examined bullets that were described as having been test fired in rifles belonging to Mr Arthur Thomas, Mr Richard Thomas and Mr [redacted] Eglinton.

Bullets fired in Mr Arthur Thomas' rifle

The bullet test fired by Dr Nelson (item 01) was relatively featureless, the exception being a significant "score" in one of the land impressions (see second land impression from the bottom of (A) in Figure 25). I compared the bullet test-fired by Dr Nelson with the bullet test fired by Mr Price. I observed no significant correspondence of striae. In my opinion, I cannot determine, by a comparison using the microscope, whether or not the bullet test fired by Dr Nelson was fired in the same rifle as the bullet test fired by Mr Price.

During my examination, I observed major changes in the surface features of the bullet from that seen when Mr Price took the Polaroid photographs to when I examined the bullets test fired by Dr Nelson (see Figures 12 to 15). In my opinion this could have been the result of repeated striking of the bullet against the glass vial that it was contained in. The documentation submitted with the bullets test fired by Mr Price (item 03) and Dr Nelson (item 01), indicated that they had both been fired in Mr Arthur Thomas' rifle. I was unable to demonstrate that by a

comparison using the microscope. However, given the apparent change to the surface of the bullet test fired by Dr Nelson, the lack of correspondence that was observed could be considered to be not significant.

Figure 23. Feature on the base of bullets (arrowed). This is most probably the result of gas erosion.

I compared two bullets that had been test fired by Mr Shanahan (item 02). These bullets displayed good quality striae. A comparison between these two test-fired bullets showed a very good correspondence of striae. A comparison of bullets test fired in the rifle of Mr Arthur Thomas by Mr Shanahan and Mr Price showed a significant correspondence of striae (e.g. see Figures 3 and 4 as an example of the correspondence observed in one groove impression). In my opinion the correspondence observed means that the bullets test fired by Mr Shanahan were fired in the same rifle as the bullets test fired by Mr Price. i.e. Mr Arthur Thomas' rifle.

I examined eleven bullets and eleven cartridge cases test-fired in Mr Arthur Thomas' rifle by Mr Price (item 04). These appeared to be a variety of different brands of ammunition. Generally the quality of the rifling was very poor and no further examination was made of these bullets.

I examined four sets of fired bullets and cartridge cases that were described as having been test fired in Mr Arthur Thomas' rifle by Mr Prescott (items 5 to 7 and 21). Generally the condition of these bullets was poor, with significant oxidation of the lead surface of the bullets. I made no further examination of these bullets.

A common feature of the bullets fired in the rifle of Mr Arthur Thomas, was the damage at the base of the bullets, particularly in the area of the land impressions. An example is shown in Figure 23. This damage is most probably caused by the action of the hot propellant powder gases on the base and bearing surface of the bullet. Whilst this damage is not reproducible such that a comparison could be made of the fine detail present, there is some general correlation of the location of these features for bullets fired in this rifle.

Bullets fired in Mr [redacted] Eglinton's rifle

I examined two bullets and two cartridge cases (item 77) test-fired in Mr [redacted] Eglinton's rifle (F3B).

The bullets had six land and groove impressions of approximately the same width as bullets test fired in Mr Arthur Thomas' rifle. Therefore in my opinion, based on the rifling characteristics of bullets test fired in Mr [redacted] Eglinton's rifle and given that Mr Thomas' rifle could not be excluded from having fired the bullets that killed Mr and Mrs Crewe, it follows that Mr [redacted] Eglinton's rifle could also not be excluded from having fired the bullets that killed Mr and Mrs Crewe.

The base of the bullets test fired in Mr [redacted] Eglinton's rifle were damaged in a similar fashion to the bullets test fired in Mr Arthur Thomas' rifle. Again, this is probably the result of gas erosion.

I compared the bullet test-fired in Mr [redacted] Eglinton's rifle with the bullet test fired in Mr Arthur Thomas' rifle and with the Polaroid photographs that show portions of exhibit 234. If Mr Eglinton's rifle had fired the recovered bullet exhibit 234, then some correspondence of the striae within the land and groove impressions might be observed upon comparison with the photographs. I observed no significant correspondence. Based on the correspondence of the number of lands and grooves and the widths of the land and groove impressions between bullets

test fired in Mr Eglinton's rifle and Mr Arthur Thomas' rifle, I cannot exclude the possibility that exhibit 234 had been fired in Mr Eglinton's rifle. However there was no significant observed correspondence of microscopic striae to support the possibility that exhibit 234 had been fired in Mr Eglinton's rifle.

Bullets fired in Mr Richard Thomas' rifle

I examined two bullets from a number of bullets and cartridge cases (PET06175/5/2) that had been test fired in Mr Richard Thomas' rifle.

These bullets had six land and groove impressions of approximately the same width as bullets test fired in Mr Arthur Thomas' rifle. Therefore in my opinion, based on the rifling characteristics of bullets test fired in Mr Richard Thomas' rifle and given that Mr Arthur Thomas' rifle could not be excluded from having fired the bullets that killed Mr and Mrs Crewe, it follows that Mr Richard Thomas' rifle could also not be excluded from having fired the bullets that killed Mr and Mrs Crewe.

I compared the bullets test fired in Mr Richard Thomas' rifle with the bullet (item 03) that Mr Price fired in Mr Arthur Thomas' rifle and found no significant correspondence of striae.

I compared the bullet test-fired in Mr Richard Thomas' rifle with the bullet test fired in Mr Arthur Thomas' rifle and with the Polaroid photographs that show portions of exhibit 234. If Mr Richard Thomas' rifle had fired the recovered bullet exhibit 234, then some correspondence of the striae within the land and groove impressions might be observed upon comparison with the photographs. I observed no significant correspondence. Based on the correspondence of the number of lands and grooves and the widths of the land and groove impressions between bullets test fired in Mr Richard Thomas' rifle and Mr Arthur Thomas' rifle, I cannot exclude the possibility that exhibit 234 had been fired in Mr Richard Thomas' rifle. However there was no significant observed correspondence of microscopic striae to support the possibility that exhibit 234 had been fired in Mr Richard Thomas' rifle.

I was informed that Mr Richard Thomas' rifle was the same make and type as that of Mr Arthur Thomas' rifle. The serial number for Mr Arthur Thomas' rifle is 86942. The serial number for Mr Richard Thomas' rifle is 129228. The serial number of rifles manufactured in the same

factory gives a guide to how closely together the rifles were manufactured. If test fired bullets were examined from two rifles that were manufactured within a short time-frame within the same factory, there might be observed some correspondence of striae in the land and groove impressions on the rifling of the bullets if the manufacturing techniques resulted in any sub-class characteristics. Conversely, the lack of any significant striae between two rifles that were manufactured within a short time-frame within the same factory, could support the view that the manufacturing process does not produce sub-class characteristics. However from the difference of over 40,000 between the serial numbers of Mr Arthur Thomas' rifle and Mr Richard Thomas' rifle, it is likely that there has been a significant time period between the manufacture of these two rifles, so therefore no inference could be made regarding sub-class characteristics from comparing the rifling of Mr Arthur Thomas' rifle and Mr Richard Thomas' rifle.

Furthermore, since significant time had elapsed between test firing Mr Arthur Thomas' rifle and Mr Richard Thomas' rifle, this lessens the chance of observing any sub-class characteristics if they existed. Over time, the condition of the barrel bore may change through wear, tear and corrosion, resulting in alteration of the striae observed in the land and groove impressions on test-fired bullets.

Figure 24. Montages of the land and groove impressions of bullets test fired in rifles belonging to Mr Richard Thomas (left) and Mr [redacted] Eglinton (right).

Figure 25. Montages of the land and groove impressions of bullets test fired in rifles belonging to: (A) Mr Arthur Thomas (left, Dr Nelson test-fired); (B) Mr Arthur Thomas (centre left, Mr Price test-fired); (C) Mr Richard Thomas (centre right); and (D) Mr [redacted] Eglinton (right).

Appendix 1: Receipt of Items

The information in this appendix is taken from laboratory records.

Item Receipt

On 11 November 2013 Ms J Wilson received the following items at the Auckland laboratory of ESR, from Detective Sergeant V McPherson:

Client sample reference	ESR sample reference	Description
01	PET1489/1	One bullet test fired in Mr Arthur Thomas' rifle by Dr D. Nelson ("F", RC01).
02	PET1489/2	Two bullets (201-3 & 201-4) test fired in Mr Arthur Thomas' rifle by Mr R. Shanahan.
03	PET1489/3	One bullet test fired in Mr Arthur Thomas' rifle by Mr Price (M32/72).
04	PET1489/4	Eleven bullets and eleven cartridge cases test fired in Mr.Arthur Thomas' rifle by Mr Price.
05	PET1489/5	One bullet and cartridge case test fired in Mr Arthur Thomas' rifle by Mr Prescott.
06	PET1489/6	One bullet and cartridge case test fired in Mr Arthur Thomas' rifle by Mr Prescott.
07	PET1489/7	One bullet and cartridge case test fired in Mr Arthur Thomas' rifle by Mr Prescott.
21	PET1489/8	One bullet and cartridge case test fired in Mr Arthur Thomas' rifle by Mr Prescott.
77	PET1489/9	Two bullets and two cartridge cases (F3B) test fired in Mr [redacted] Eglinton's rifle.
18	PET1489/10	Twenty-three Polaroid photos taken by Mr Price and eight Talyrond discs

On receipt the items were labelled with the laboratory reference PET1489 and placed into secure storage, pending examination.

On 15 August 2013 Mr Gerhard Wevers received a rifle belonging to Mr R. Thomas from Detective Senior Sergeant G. Lendrum. This rifle was test fired and samples were kept as described below:

Client sample reference	ESR sample reference	Description
	PET06175/5/2	Twelve bullets and twelve cartridge cases test fired in Mr Richard Thomas' rifle by Mr G. Wevers.
02	PET06175/6/1	Barrel cast of Mr Richard Thomas' rifle by Mr G. Wevers.

These items were labelled with the laboratory reference PET06175 and placed into secure storage, pending examination.

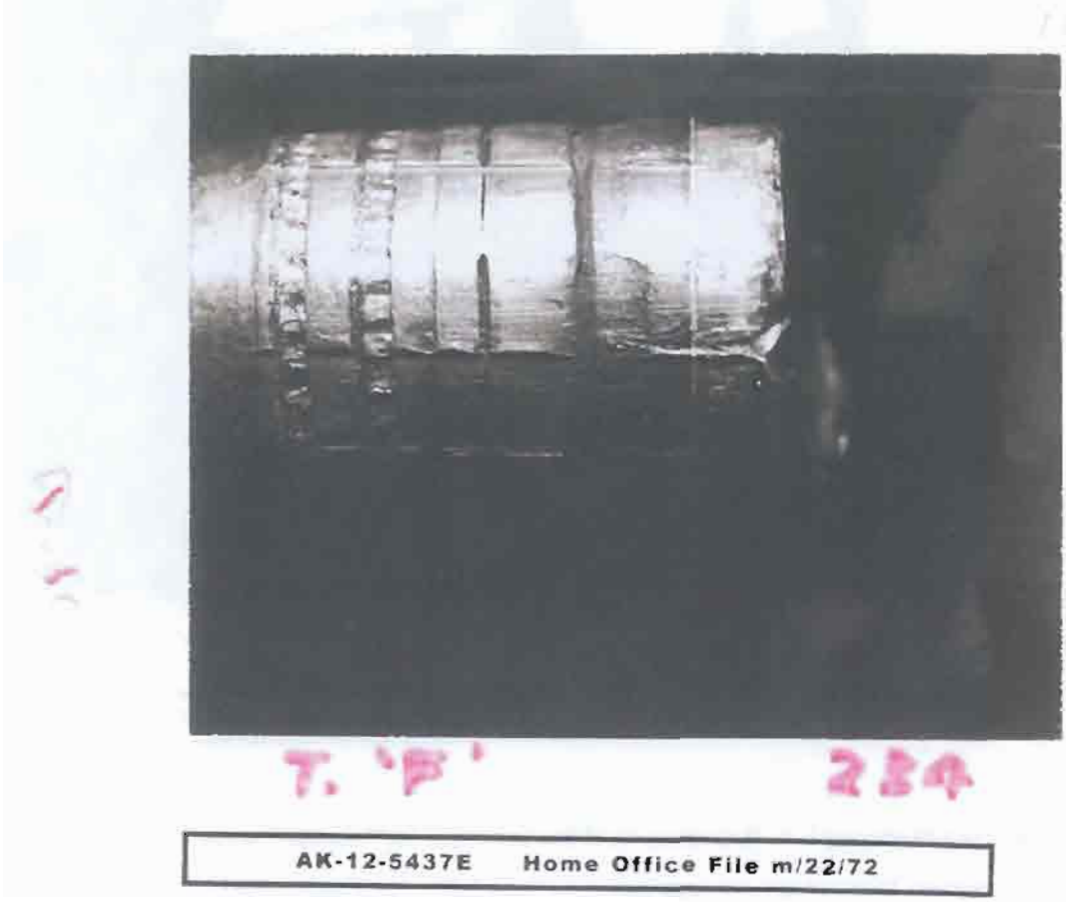
Appendix 2: Summaries of the twenty-three Polaroid Photographs taken by Mr P Price of the Home Office.

Police IMG #	Allocated #	Land or groove #	Test Bullet compared	Exhibit # compared	Magnification
4738	1	1	F	234	10x
4740	2	1	F	234	20x
4718	3	1	F	234	20x
4720	4	1	F	234	50x
4736	5	1	F	234	50x
4742	6	2	F	234	20x
4721	7	2	F	234	50x
4722	8	2	F	234	50x
4739	9	3	F	234	10x
4723	10	3	F	234	20x
4729	11	0	T	234	50x
4741	12	0	T	234	50x
4719	13	1	T	234	20x
4726	14	?	T	234	50x
4725	15	?	T	234	50x
4728	16	1	T	234	50x
4737	17	2	T	234	10x
4724	18	2	T	234	20x
4743	19	2	T	234	50x
4731	20	-	F	289	10x
4732	21	-	F	289	20x
4716	22			234	10x
4717	23		F		10x

Police IMG #	Allocated #	Land or groove #	Test Bullet compared	Exhibit # compared	Magnification
4716	22			234	10x
4717	23		F		10x
4718	3	1	F	234	20x
4719	13	1	T	234	20x
4720	4	1	F	234	50x
4721	7	2	F	234	50x
4722	8	2	F	234	50x
4723	10	3	F	234	20x
4724	18	2	T	234	20x
4725	15	?	T	234	50x
4726	14	?	T	234	50x
4728	16	1	T	234	50x
4729	11	0	T	234	50x
4731	20		F	289	10x
4732	21		F	289	20x
4736	5	1	F	234	50x
4737	17	2	T	234	10x
4738	1	1	F	234	10x
4739	9	3	F	234	10x
4740	2	1	F	234	20x
4741	12	0	T	234	50x
4742	6	2	F	234	20x
4743	19	2	T	234	50x

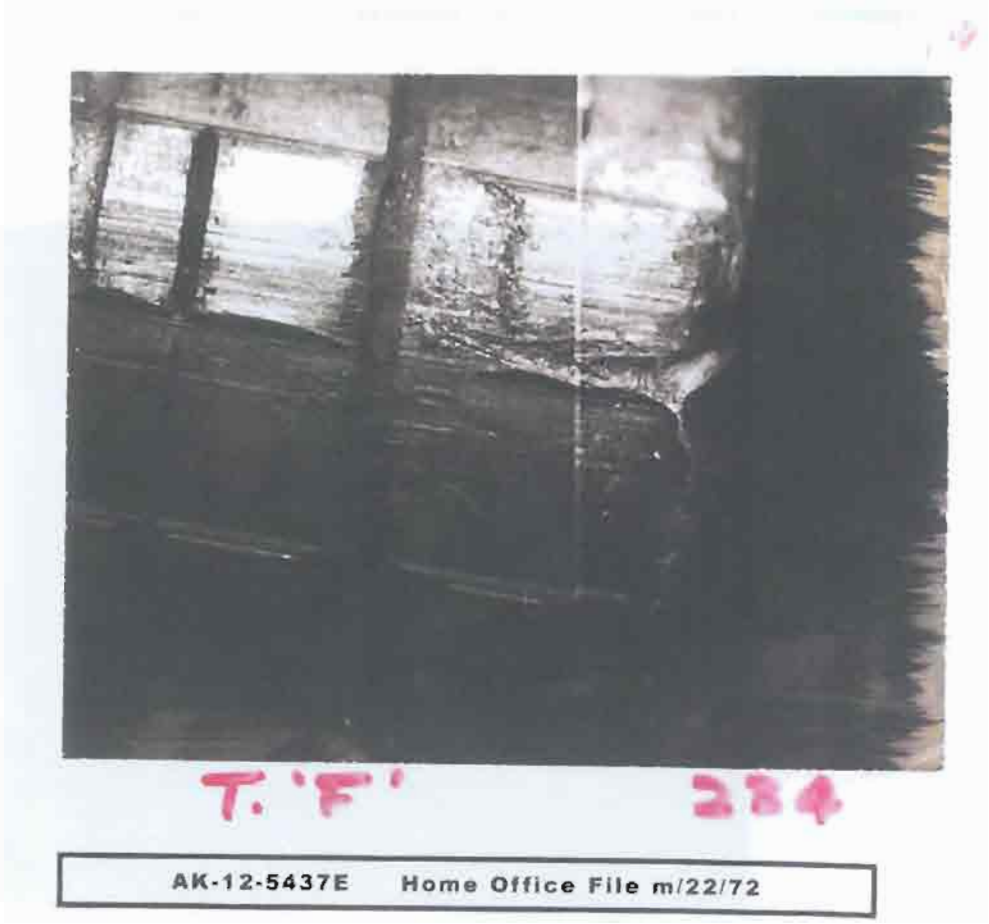
Appendix 3: Twenty-three Polaroid Photographs taken by Mr P Price of the Home Office.

Dr Nelson test-fired bullet vs exhibit 234 - Groove impression 1



Polaroid Photograph 1. Comparison between groove impression 1 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).

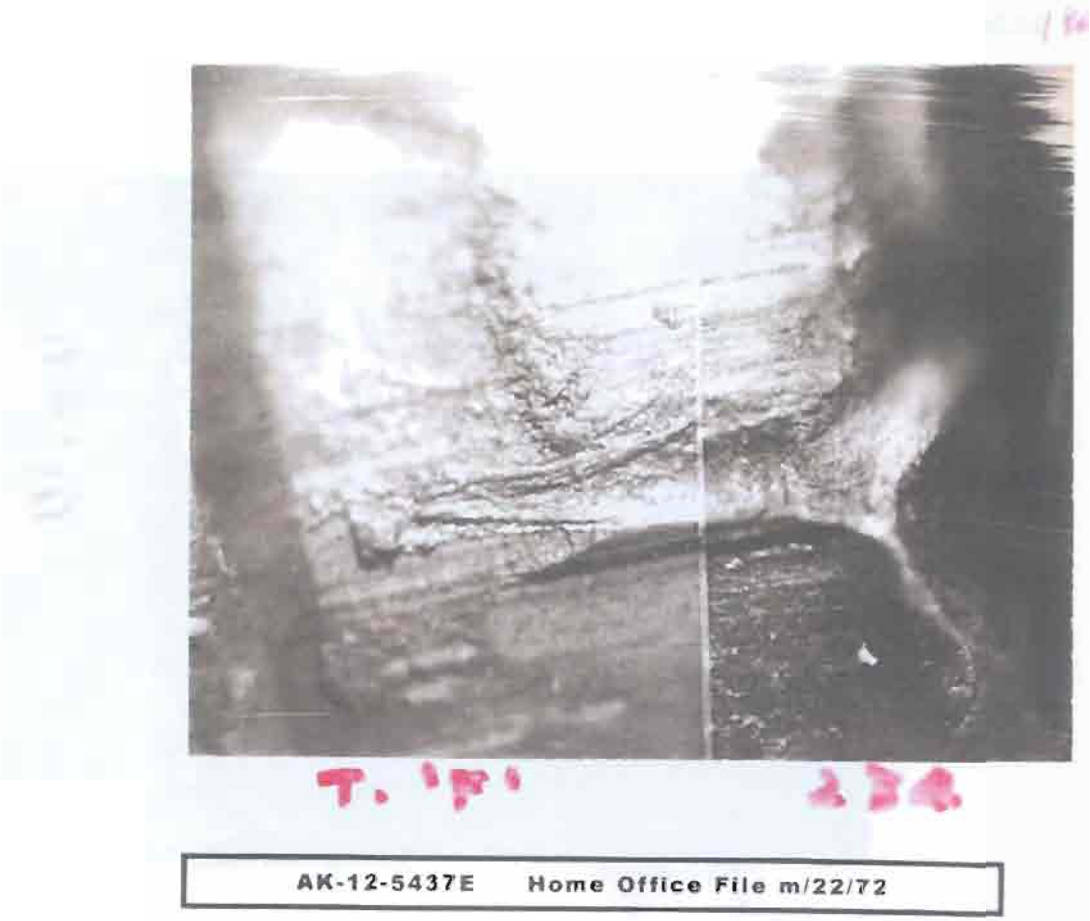
The photograph was taken at 10x magnification. [Police Image: _MG_4738.jpg]



Polaroid Photograph 2. Enlargement of the view seen in Polaroid Photograph 1. The comparison between groove impression 1 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 20x magnification. [Police Image: _MG_4740.jpg]

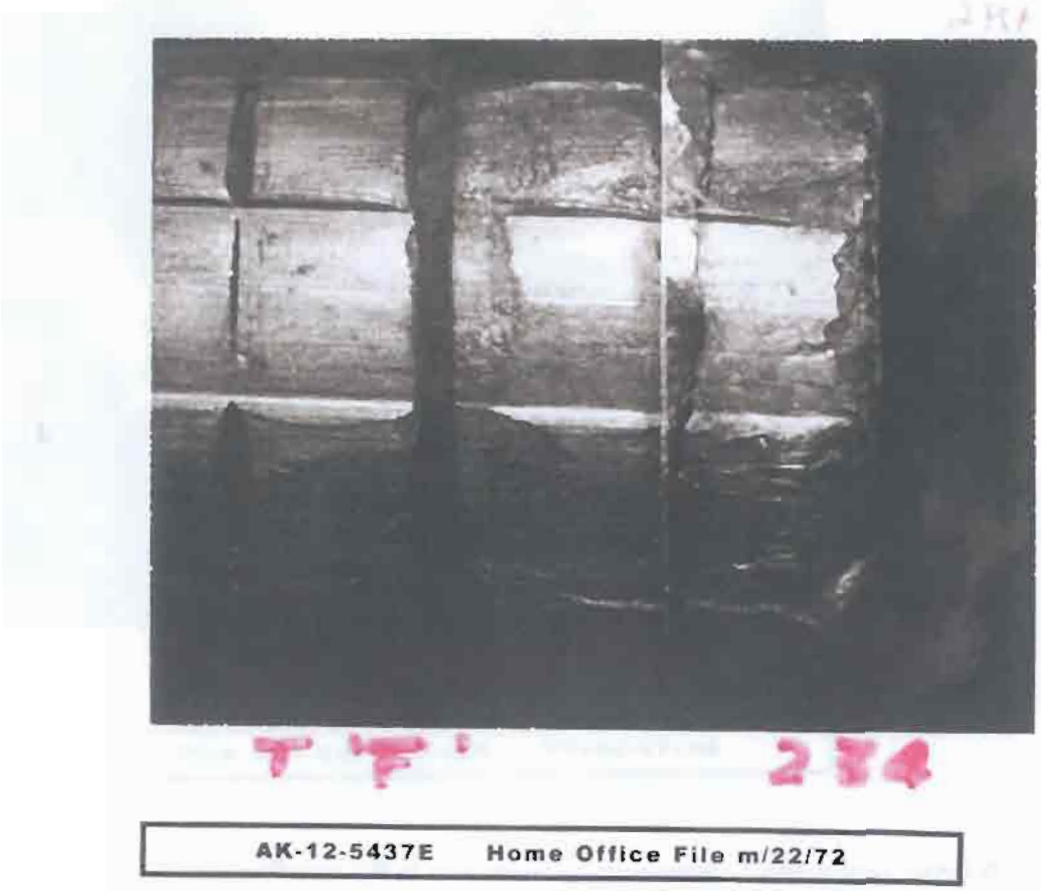
Polaroid Photograph 3. Same comparison as seen in Polaroid Photograph 2.
The comparison between groove impression 1 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 20x magnification. [Police Image: _MG_4718.jpg]

Polaroid Photograph 4. Enlargement of the view seen in Polaroid Photographs 1, 2 and 3. The comparison between groove impression 1 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right). The photograph was taken at 50x magnification. [Police Image: _MG_4720.jpg]



Polaroid Photograph 5. Same comparison as seen in Polaroid Photograph 4.
The comparison between groove impression 1 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 50x magnification. [Police Image: _MG_4736.jpg]

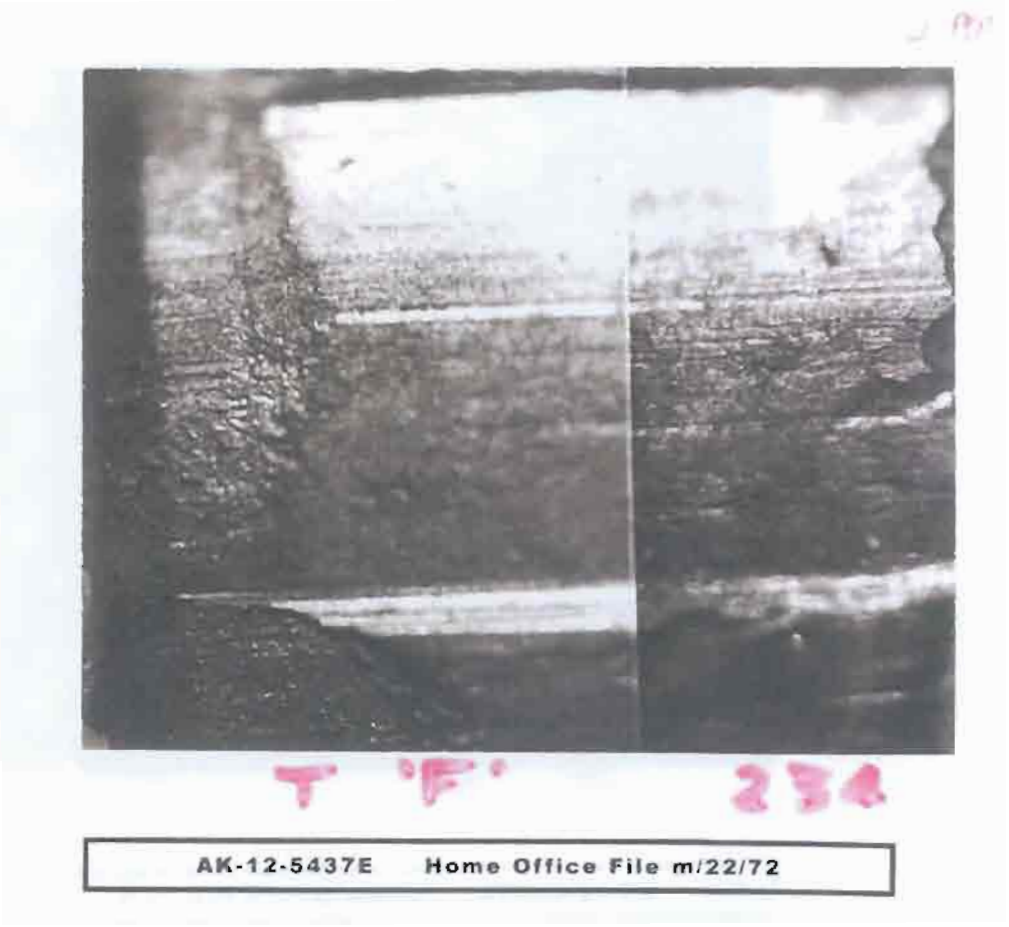
Dr Nelson test-fired bullet vs exhibit 234 - Land impression 2



Polaroid Photograph 6. Comparison between land impression 2 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).

The photograph was taken at 20x magnification. [Police Image: _MG_4742.jpg]

Polaroid Photograph 7. Enlargement of the view seen in Polaroid Photograph 6.
Comparison between land impression 2 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 50x magnification. [Police Image: _MG_4721.jpg]

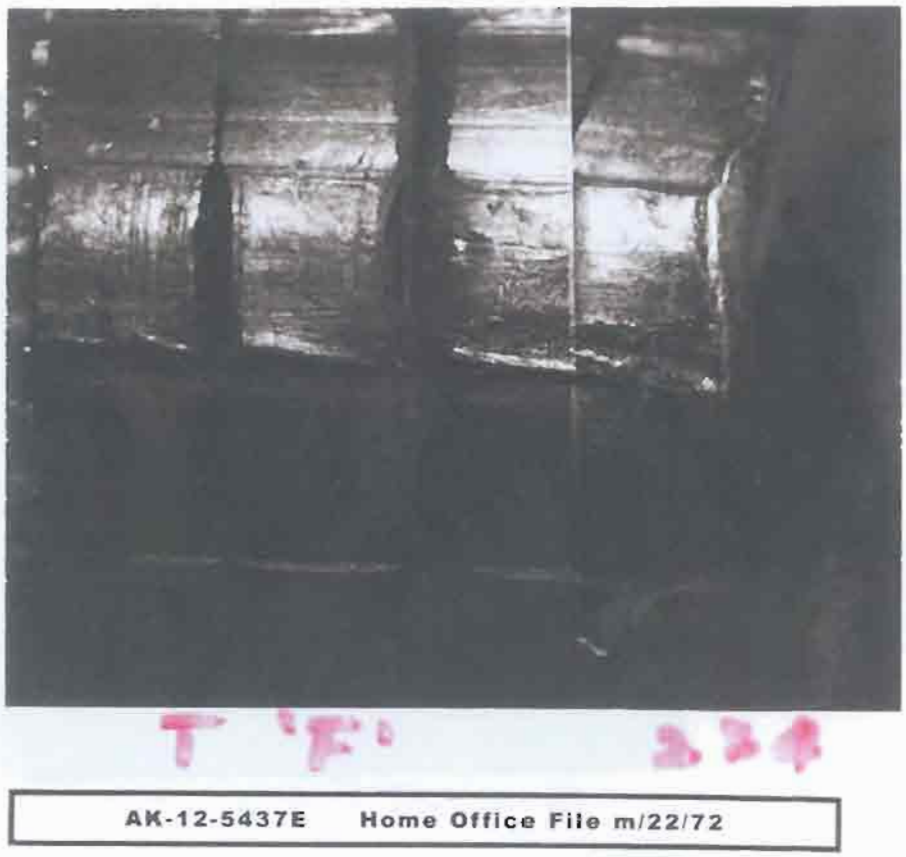


Polaroid Photograph 8. Same comparison as seen in Polaroid Photograph 7.
Comparison between land impression 2 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 50x magnification. [Police Image: _MG_4722.jpg]

Dr Nelson test-fired bullet vs exhibit 234 - Groove impression 3

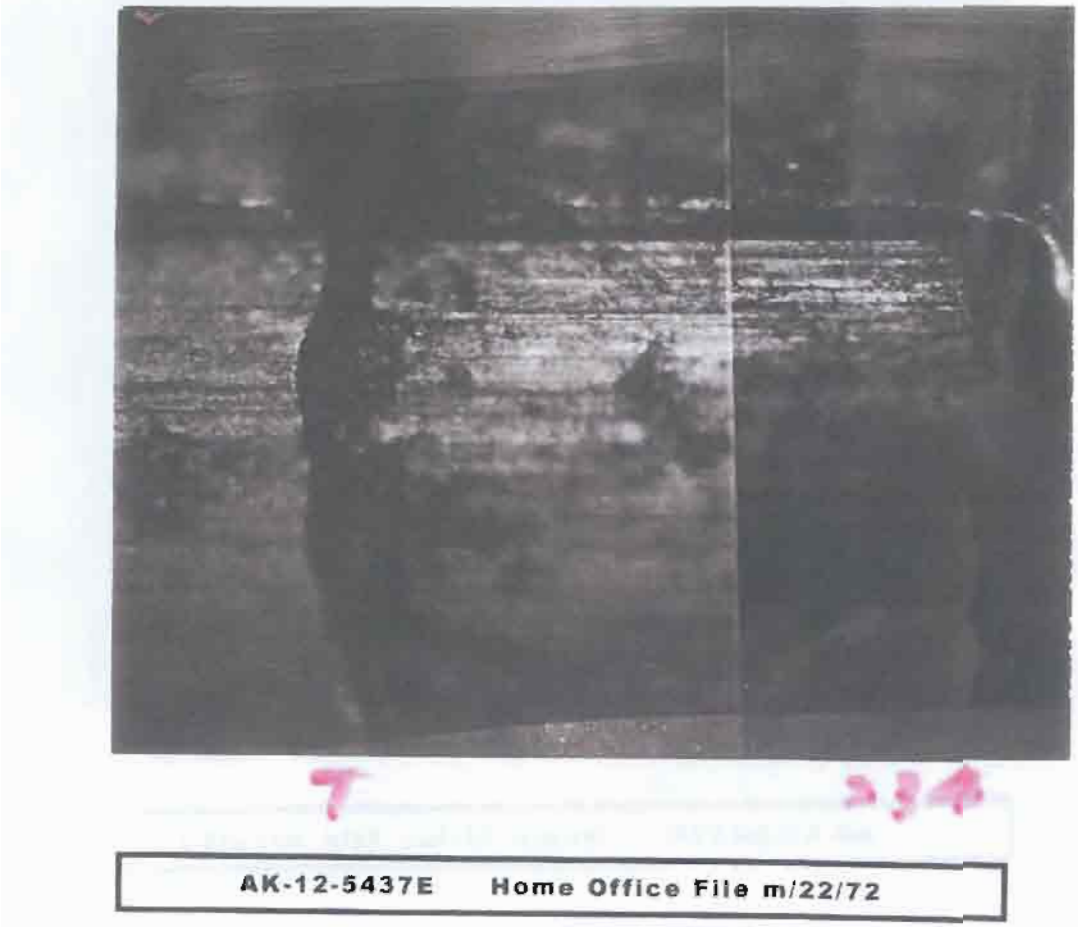
Polaroid Photograph 9. Comparison between groove impression 3 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).

The photograph was taken at 10x magnification. [Police Image: _MG_4739.jpg]

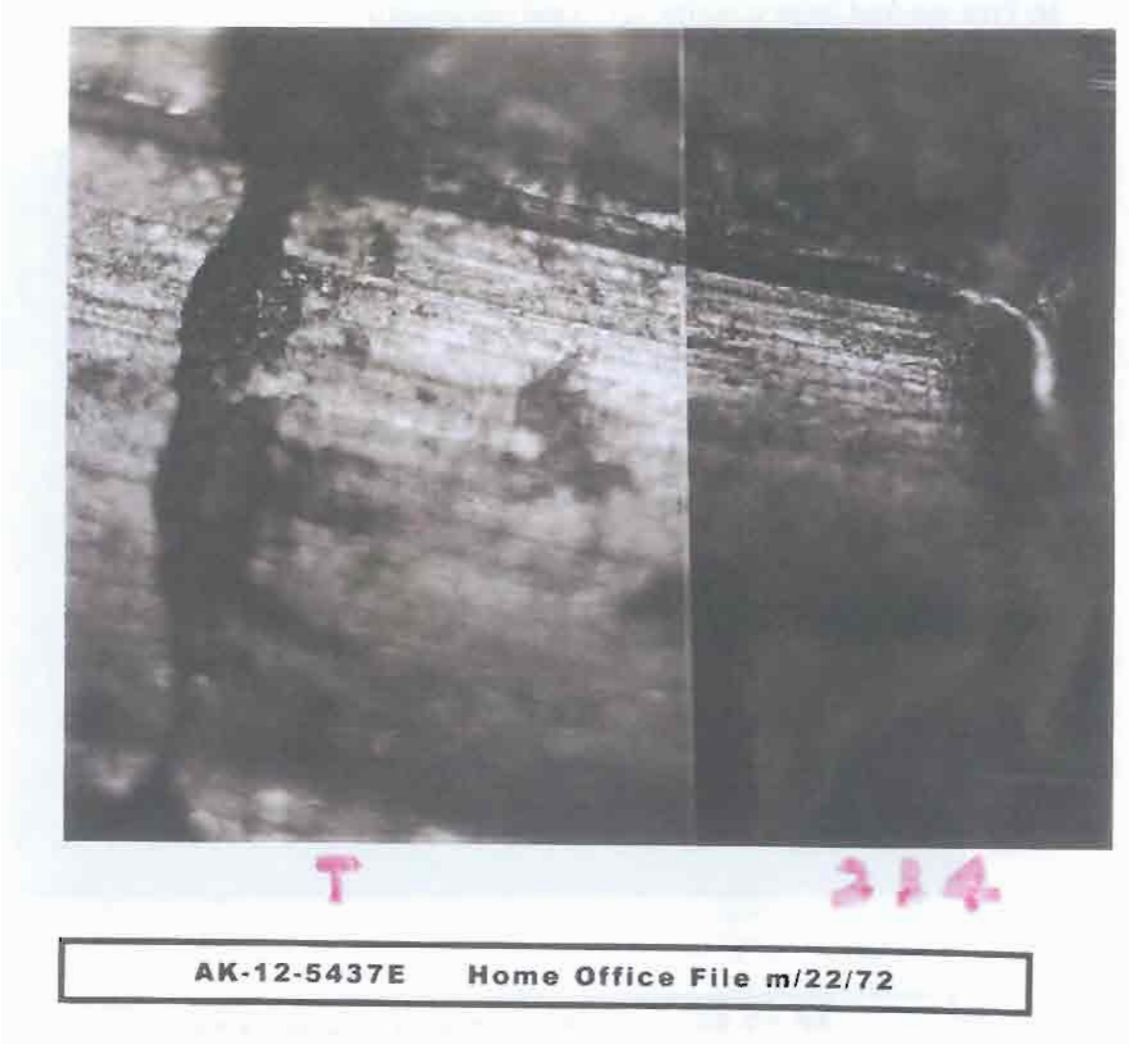


Polaroid Photograph 10. Enlargement of the view seen in Polaroid Photograph 9.
Comparison between groove impression 3 of the bullet test fired by Dr Nelson ("TF" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 20x magnification. [Police Image: _MG_4723.jpg]

Mr Price test-fired bullet vs exhibit 234 - Land impression 0

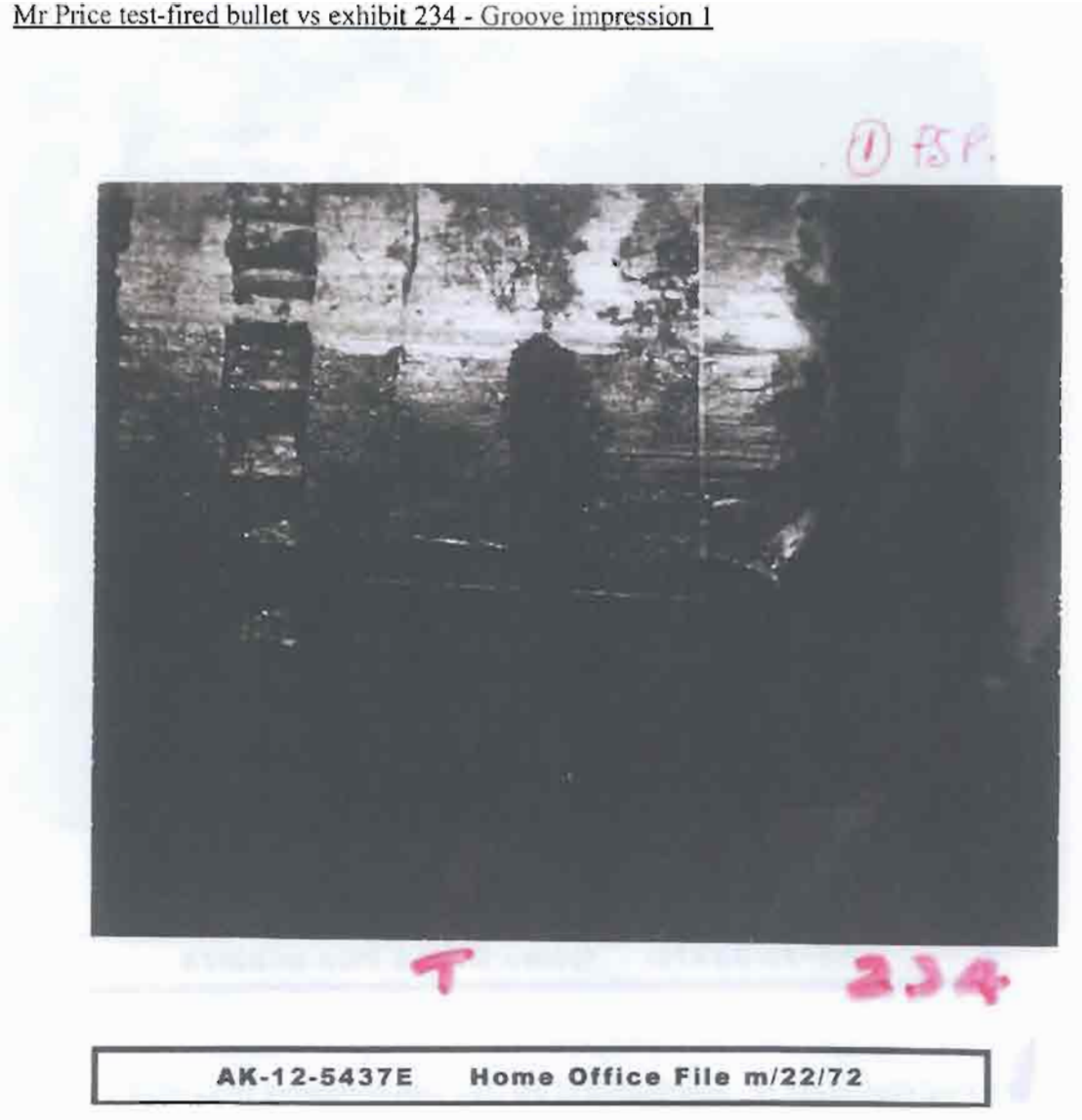


Polaroid Photograph 11. Comparison between land impression 0 of the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right). The photograph was taken at 50x magnification. [Police Image: _MG_4729.jpg]



Polaroid Photograph 12. Same comparison as seen in Polaroid Photograph 11.
Comparison between land impression 0 of the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 50x magnification. [Police Image: _MG_4741.jpg]

Mr Price test-fired bullet vs exhibit 234 - Groove impression 1



Polaroid Photograph 13. Comparison between groove impression 1 of the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).

The photograph was taken at 20x magnification. [Police Image: _MG_4719.jpg]

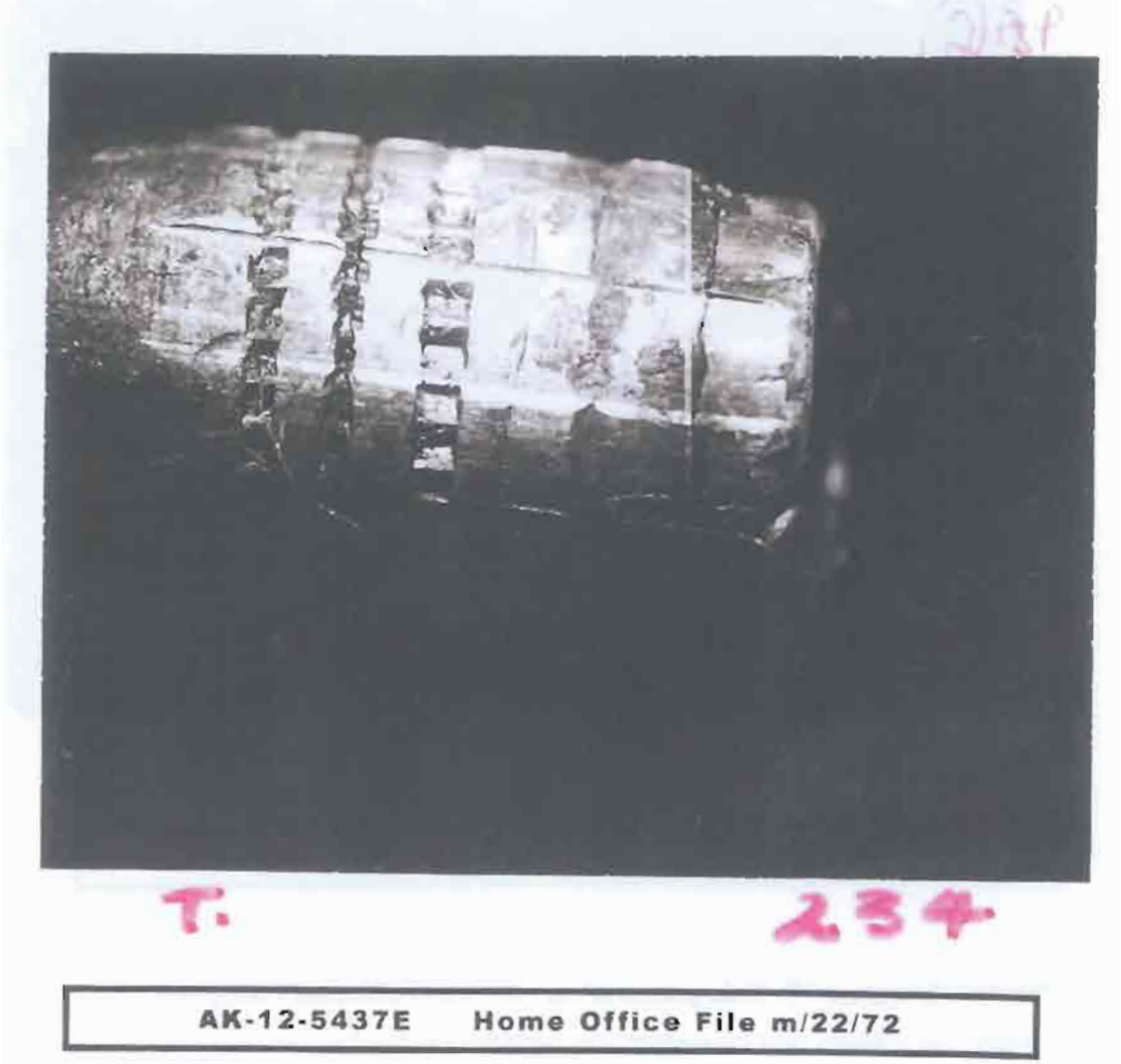
Polaroid Photograph 14. Enlargement of the view seen in Polaroid Photograph 13. Comparison between the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right). The source of this groove impression could not be determined.

The photograph was taken at 50x magnification. [Police Image: _MG_4726.jpg]

Polaroid Photograph 15. Same comparison as seen in Polaroid Photograph 14.
Comparison between the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right). The source of this groove impression could not be determined.
The photograph was taken at 50x magnification. [Police Image: _MG_4725.jpg]

Polaroid Photograph 16. Same comparison as seen in Polaroid Photograph 13.
Comparison between groove impression 1 of the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 50x magnification. [Police Image: _MG_4728.jpg]

Mr Price test-fired bullet vs exhibit 234 - Land impression 2

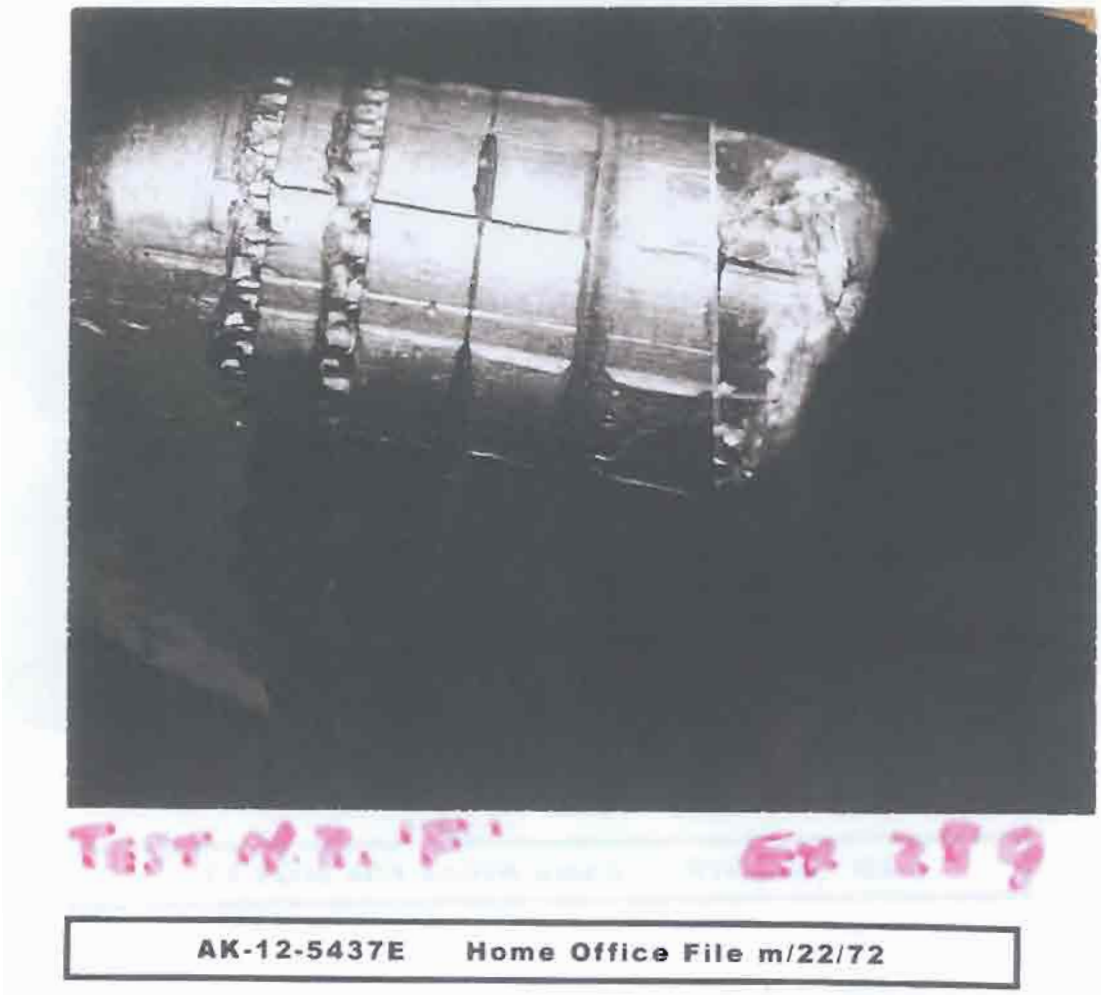


Polaroid Photograph 17. Comparison between land impression 2 of the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right). The photograph was taken at 10x magnification. [Police Image: _MG_4737.jpg]

Polaroid Photograph 18. Enlargement of the view seen in Polaroid Photograph 17.
Comparison between land impression 2 of the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 20x magnification. [Police Image: _MG_4724.jpg]

Polaroid Photograph 19. Enlargement of the view seen in Polaroid Photograph 18.
Comparison between land impression 2 of the bullet test fired by Mr Price ("T" left) and exhibit 234, recovered from the body of Mrs Jeannette Crewe ("234" right).
The photograph was taken at 50x magnification. [Police Image: _MG_4743.jpg]

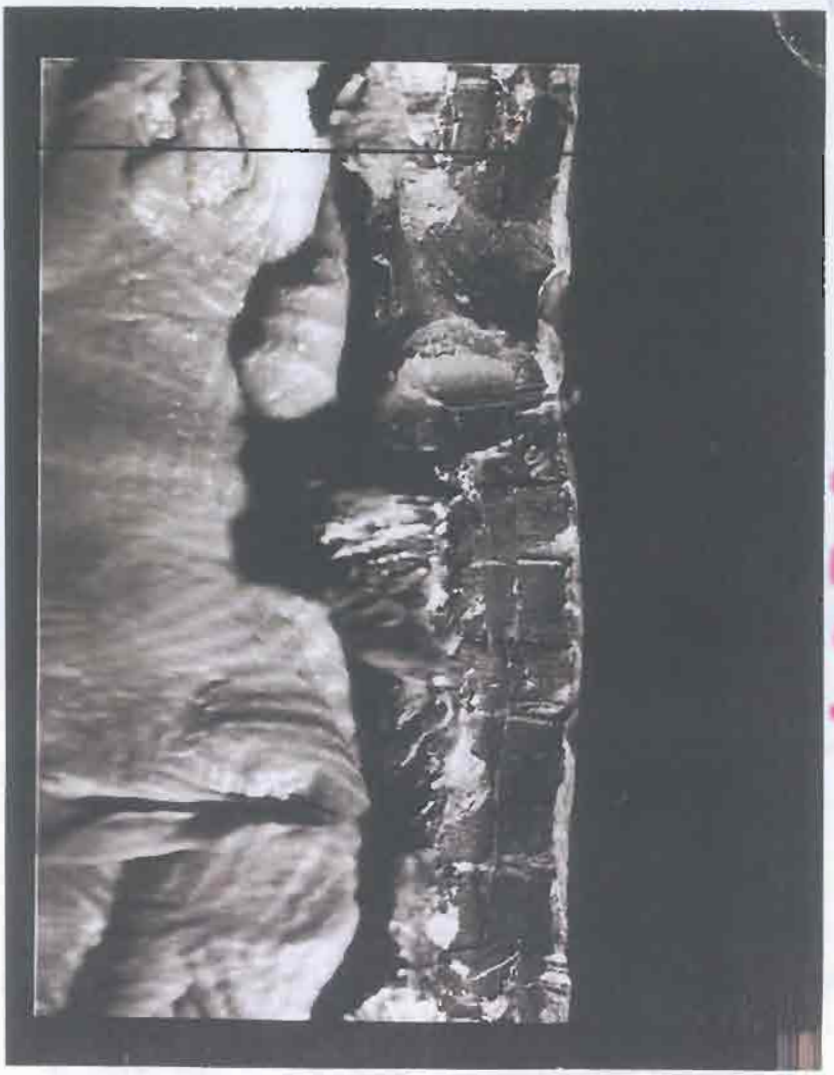
Dr Nelson test-fired bullet vs exhibit 289



Polaroid Photograph 20. Comparison between the bullet test fired by Dr Nelson ("TEST NZ F" left) and exhibit 289, recovered from the body of Mr Harvey Crewe ("Ex 289" right). The photograph was taken at 10x magnification. [Police Image: _MG_4731.jpg]

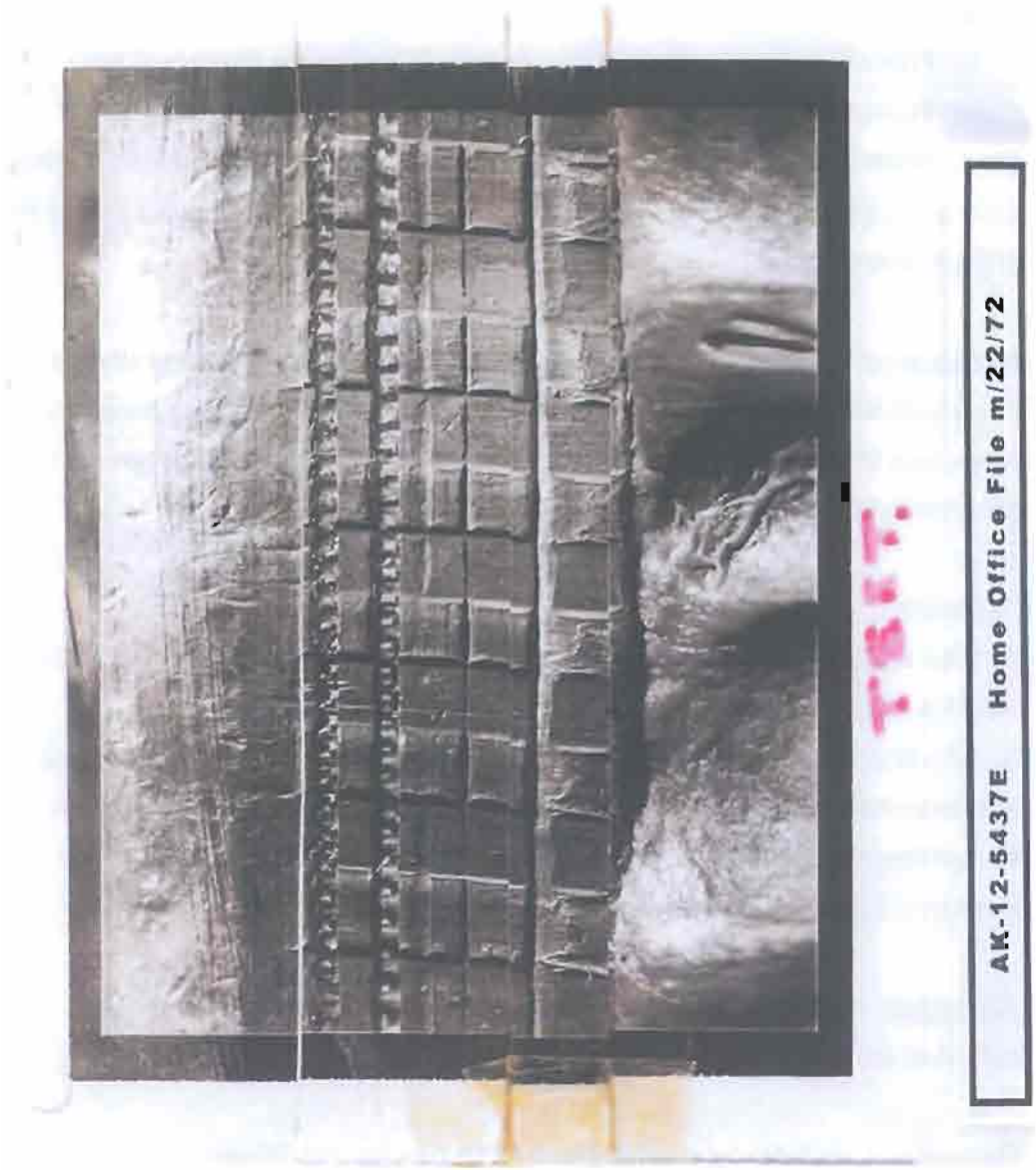
Polaroid Photograph 21. Enlargement of the view seen in Polaroid Photograph 21. Comparison between the bullet test fired by Dr Nelson ("TEST NZ F" left) and exhibit 289, recovered from the body of Mr Harvey Crewe ("Ex 289" right).
The photograph was taken at 20x magnification. [Police Image: _MG_4732.jpg]

Exhibit 234, recovered from the body of Mrs Jeannette Crewe



Polaroid Photograph 22. Photograph showing Exhibit 234, recovered from the body of Mrs Jeannette Crewe. This has been possibly made by rolling the bullet into a yielding surface, then casting it.
The photograph was probably taken at 10x magnification. [Police Image: _MG_4716.jpg]

Dr Nelson test-fired bullet



Polaroid Photograph 23. A photograph showing the bullet that was test fired in Mr A. Thomas' rifle by Dr Nelson. This has been possibly made by rolling the bullet into a yielding surface, then casting it. [Police Image: _MG_4717.jpg]
There are vertical cuts to this photograph, possibly to enable overlaying of this photograph onto other photographs of interest. The photograph was probably taken at 10x magnification.

Appendix 4: Brief summary of Theory relating to Firearms Identification.

There are three approaches to interpreting microscopic comparisons of bullets:

1. **Traditional Subjective Criteria - Range of Conclusions Possible When Comparing Toolmarks**

The examiner is encouraged to report the objective observations that support the findings of toolmark examinations. The examiner should be conservative when reporting the significance of these observations.

Identification: Agreement of a combination of individual characteristics and all discernible class characteristics where the extent of agreement exceeds that which can occur in the comparison of toolmarks made by different tools and is consistent with the agreement demonstrated by toolmarks known to have been produced by the same tool.

Inconclusive:

A. Some agreement of individual characteristics and all discernible class characteristics, but insufficient for an identification.

B. Agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility.

C. Agreement of all discernable class characteristics and disagreement of individual characteristics, but insufficient for an elimination.

Elimination: Significant disagreement of discernible class characteristics and/or Individual characteristics.

Unsuitable: Unsuitable for examination. [AFTE Glossary, 5th Edition]

2. Consecutive Matching Striae (CMS)

One approach to striated mark comparisons is the application of consecutive matching striae (CMS) as a quantitative method of describing an observed pattern match. CMS is simply a means of articulating the best known non-match described and defined by the AFTE Theory of Identification.

In an extensive analysis of 720 known non-match comparisons of land and groove impressions in fired bullets by Al Biasotti in 1959, he found no instances in which the CMS exceeded four. In 1997, Biasotti and Murdock published their conservative quantitative criteria for identification as expressed in terms of CMS;

"In three dimensional toolmarks when at least two different groups of at least three consecutive matching striae appear in the same relative position, or one group of six consecutive matching striae are in agreement in an evidence toolmark compared to a test toolmark. For these criteria to apply, however, the possibility of subclass characteristics must be ruled out."

3. Bayesian approach (or use of the Likelihood ratio)

The evidential value of a bullet comparison can be interpreted by considering two opposing hypotheses; one hypothesis being that the bullet was fired in the rifle submitted for examination, and the other hypothesis being that the bullet was fired in another rifle.
The likelihood ratio considers two competing propositions;

- The probability of the evidence given that the two bullets were fired in the same rifle. i.e. what is the probability of seeing that level of correspondence of striae between two bullets that were fired in the same rifle? For two bullets fired in the same rifle the probability of seeing a correspondence of striae is high.
- The probability of the evidence given that the two bullets were fired in different rifles. i.e. what is the probability of seeing that level of correspondence of striae between two bullets that were fired in different rifles? For two bullets fired in different rifles, the probability of seeing a correspondence of striae is low.

The likelihood ratio (for a bullet comparison) will be the ratio of the probability of the evidence given that the two bullets were fired in the same rifle over the probability of the evidence given that the two bullets were fired in different rifles.

Where there is a very good observed correspondence of striae, the numerator will be high (close to 1) and the denominator will be low (close to zero). The resultant likelihood ratio will be high, which reflects the evidence of very good observed correspondence of striae between the two bullets (one test fired in a rifle and the other recovered from a crime scene).

The range of conclusions used at ESR is as follows;

Verbal "equivalent"	**Likelihood Ratio**
is conclusive	[No mathematical expression]
provides extremely strong support [for H]	over 1,000,000
provides very strong support [for H]	1000-1,000,000
provides strong support [for H]	100-1000
provides moderate support [for H]	10-100
provides slight support [for H]	1-10
is neutral	1
provides slight support [against H]	1-0.1
provides moderate support [against H]	0.1-0.01
provides strong support [against H]	0.01-0.001
provides very strong support [against H]	0.001-0.000001
provides extremely strong support [against H]	less than 0.000001
is excluded	0

Appendix 8

(7)

.22 Rifle Collection Phase Testing Schedule

.22 RIFLE COLLECTION PHASE TESTING

Name	.22 Rifle	Type	Serial No.	Date Seized	Tag Number	Date Tested by Dr. Nelson	Test Shots Fired	RH Twist / LH Twist	Lands (Rifling)	Testing Comments	Date Returned
BELL / R / G	Bruno	Magazine Loaded	75364	18.08.1970	C8B	18.08.1970	3	RH	6	6R but land marks about 9/10 width of fatal	03.09.1970
BURLING / G / B	BSA	Single Shot	JB30417	20.08.1970	P28B	06.10.1970	3	RH	4	4R	09.10.1970
CARLSON / R	Hornet		2154 Model 24	Viewed 27.08.1970							
CHANDLER / W / R	Slazenger	Magazine Loaded	46216	23.08.1970	P21B/21A	26.08.1970	3	RH	4	4R 4/5 of fatal	
DEMLER / H / L	Lithgow		139081	15.10.1970							27.11.70
DUNLOP / R / W	BSA	Single Shot	LB17828	18.08.1970	P2B/2A	18.08.1970	3	RH	4	4R	19.08.1970
EYRE / A / S	BSA	Pump Action	868	18.08.1970	C2B	18.08.1970	3	RH	8	8R looks like bottom Rifiling	19.08.1970
EYRE / A / S (BREWSTER)	Remington	Pump Action	786596	18.08.1970	C3B	18.08.1970	3	RH	6 [5]	6R rifiling class same as exhibit. Can't exclude. Same class as death bullet but fine structure doesn't match. Differences in fine structure between Death bullet & C3B less than differences within C3B. Same class.	08.09.1970
EYRE / D / L	Remington	Semi Auto	BK40	18.08.1970	P16B	26.08.1970	6	RH	6	6R 2/5	02.09.1970
EYRE / K / J	BSA	Single Shot	35467	18.08.1970	P15B	26.08.1970	3	RH	4	4R	02.09.1970
FOOTE / G	Tisco	Magazine Loaded	79077	19.08.1970	P17B	26.08.1970	3	RH	6	6R 2/5	02.09.1970
FOOTE / G	Gevarne	Semi Auto	114547	19.08.1970	P18B	26.08.1970	3 [only 2 recovered]	RH	6	6R 1.1 to 1.2 wider	02.09.1970

.22 RIFLE COLLECTION PHASE TESTING

Name	.22 Rifle	Type	Serial No.	Date Seized	Tag Number	Date Tested by Dr. Nelson	Test Shots Fired	RH Twist / LH Twist	Lands (Rifling)	Testing Comments	Date Returned
FOOTE / L / W	Plinker	Single Shot	155845	18.08.1970	P8B	18.08.1970	3	RH	6	6R 1/2 width of fatal	19.08.1970
FOX / R / L	BSA	Single Shot	K11136	18.08.1970	P6B/6A	18.08.1970	3	RH	4	4R	19.08.1970
FULTON / N				Not useable, not seized							
GARRETT / E / C	Carbine	Single Shot	94562	18.08.1970	C7B	18.08.1970	3	RH	4	4R	03.09.1970
GASKELL / N / W	BSA	Magazine Loaded	1055S	18.08.1970	P7B	18.08.1970	3	RH	4	4R	19.08.1970
GILLIES / J / R	Slazenger	Magazine Loaded	31629	18.08.1970	P4B	18.08.1970	3	RH	4	4R	19.08.1970
GREER / J / F	Savage	Single Shot	3B	17.08.1970	C1A	18.08.1970	3	RH	6	6R but land mark only 1/2 width of fatal	19.08.1970
GRIFFIN / J	Mossberg			Seen but not seized							
HANCOCK / A	Winchester Model 72	Repeater Action	1367	24.08.1970	C16B	26.08.1970	3	RH	4	4R badly worn	03.9.1970
HANSEN / M / L	Winchester	Pump Action	678622	24.08.1970	P23B	26.08.1970	3	RH	6	6R 4/5	02.09.1970
HANSEN / R / L	Sportco	Pump Action	NA1072	24.08.1970	P25B	26.08.1970	3	LH	6	6L 2/3 of fatal	02.09.1970
HANSEN / R / L	Sportco	Magazine Loaded	EJ763	24.08.1970	P26B	26.08.1970	3	LH	4	4L	02.09.1970
HEWITT / M / A	Carbine	Semi Auto	100104	18.08.1970	P3B	18.08.1970	3	RH	6	6R 4/5 width of fatal land marks	19.08.1970
HEWSON / G / R	BSA	Repeater Action	LE58722	26.08.1970	K2B	06.10.1970	3	RH	4	4R	17.12.1970
IRVING / L / E	Harrington & Richardson		V2805	Not Seized 27.08.1970							
LOGAN / A	Savage	Single Shot	Model 3C	20.08.1970	C12B	26.08.1970	3	RH	6	6R 2/5 of fatal	03.09.1970

.22 RIFLE COLLECTION PHASE TESTING

Name	.22 Rifle	Type	Serial No.	Date Seized	Tag Number	Date Tested by Dr. Nelson	Test Shots Fired	RH Twist / LH Twist	Lands (Rifling)	Testing Comments	Date Returned
MANGA / J / R	Slazenger	Magazine Loaded	215548	19.08.1970	P11B	26.08.1970	3	RH	4	4R	02.09.1970
MARTIN / G / L	Savage	Single Shot	1254	25.08.1970	M2A	26.08.1970	3	RH	6	6R 2/5 width	03.09.1970
MARTIN / J / L	Winchester	Single Shot	Model 67	25.08.1970	M1A	26.08.1970	3	RH	4	4R very wide or a lot of slippage	03.09.1970
McCONACHIE / M / D	Trico	Magazine Loaded	25186	19.08.1970	P14B	26.08.1970	3	RH	6	6R 2/5	02.09.1970
McNAMARA / D / W	Remington	Single Shot	Model 41, 24852	24.08.1970	K1B	26.08.1970	3	RH	4	4R	02.09.1970
NICHOLLS / J / R	Gevarne	Magazine Loaded	202012	27.08.1970	P29B	06.10.1970	3	RH	6	6R 7/8 fatal	09.10.1970
NORRIS / P / T	Winchester	Single Shot	10585	19.08.1970	P20B	26.08.1970	3	RH	4	4R (hair trigger)	02.09.1970
PACEY / D / L	Sportomatic	Repeater Action	87A	24.08.1970	C17A	26.08.1970	3	LH	6	6L 2/3 of fatal	03.09.1970
PIRRETT / B				Not in useable condition, not seized							
REEVE / H	Winchester	Pump Action	7244	Viewed 27.08.1970, not seized							
ROBINSON / H / J	Winchester Covey Model	Single Shot	E291	19.08.1970	P19B	26.08.1970	3	RH	8	8R (hair trigger)	02.09.1970
RODDICK / A / E	Trico	Magazine Loaded	28558	26.08.1970	P27B	26.08.1970	3	RH	6	6R 2/5 (1½ recovered) (hair trigger)	02.09.1970
SCOTT / L / R	BRNO	Magazine Loaded	114000	24.08.1970	P22B	26.08.1970	3	RH	6	6R 9/10 of fatal width	03.09.1970
SOUTER / W / B	Lithgow	Single Shot	72222	25.08.1970	P24B	26.08.1970	3	RH	6	4R	02.09.1970

.22 RIFLE COLLECTION PHASE TESTING

Name	.22 Rifle	Type	Serial No.	Date Seized	Tag Number	Date Tested by Dr. Nelson	Test Shots Fired	RH Twist / LH Twist	Lands (Rifling)	Testing Comments	Date Returned
SPRATT / I / D	Winchester	Single Shot		18.08.1970	C4A	18.08.1970	3	WORN	WORN	Rifle so badly worn that land marks not recognisable	19.08.1970
THOMAS / A / A	Browning Pump	Pump Action	86942	17.08.1970	C10A	18.08.1970	3	YES	6	6R Rifling class identical but no match seen. If rare possibility that scored land mark of t was missing mark of Fatal then cannot exclude. Same class characteristics	08.09.1970
THOMAS / A / A	Browning Pump	Pump Action	86942	20.10.1970	C10A	29.10.1970 [Shanahan]	?	YES	6	6R	26.02.1981
THOMAS / C / M	Plinker	Single Shot	GECADO	20.08.1970	C11A	26.08.1970	4	RH	6	6R 3/4 or 4/5 of fatal	03.09.1970
THOMAS / H / M	Remington	Pump Action	370175	18.08.1970	P1B	18.08.1970	3	RH	6	6R 2/5 width of fatal	19.08.1970
THOMAS / R / J	Browning	Pump Action	129228	14.10.1970	P30A						
THORNE / C / C	Gevarm			Not Seized							
WARE / C / H	Slazenger	Single Shot	156205	18.08.1970	P9B	18.08.1970	3	RH	4	4R	19.08.1970
WHITEHEAD / B / J	Springfield	Single Shot	Model 83	24.08.1970	C15B	26.08.1970	3	RH	6	6R 2/5 of fatal	03.09.1970
WILLIAMS / D / J	Gevarne	Magazine Loaded	62947	19.08.1970	P12B	26.08.1970	3	RH	6	6R 4/5 of fatal (owns magazine)	02.09.1970
WILLIS / G	Browning	Pump Action	38271	18.08.1970	C9A	18.08.1970	3	RH	6	6R approx 4/5 width of fatal	03.09.1970
WOOTEN / H / D	Savage	Repeater Action	8371	24.08.1970	C13B	26.08.1970	3	RH	6	6R 2/5 of fatal	03.09.1970
WRENCH / D / H	T03-17	Magazine Loaded	Bolt 1748	18.08.1970	C5A	18.08.1970	3	RH	6	4R exclude	19.08.1970
YEARBURY / W / J	Stevens	Single Shot	Model 87D, No SN visible	19.08.1970	P13B	26.08.1970	3	RH	6	6R 2/5	02.09.1970

.22 RIFLE COLLECTION PHASE TESTING

Name	.22 Rifle	Type	Serial No.	Date Seized	Tag Number	Date Tested by Dr. Nelson	Test Shots Fired	RH Twist / LH Twist	Lands (Rifling)	Testing Comments	Date Returned
OTTER / R / S	Armatic	Magazine Loaded	H1795	23.08.1970	C14B	26.08.1970	3	RH	6	6R 2/5 or 1/2 of fatal	03.09.1970
ALEXANDER / D	Gevarne	Semi Auto	109118	17.08.1970	C6B	18.08.1970	3	RH	6	6R land markings very slightly wider than fatal bullet and very rough and scored. Same Class. Exclude: Also marks too scored also 15 too wide also 35 too wide	03.09.1970
HAWKER / J / G	Winchester	Single Shot	Model 67	14.10.1970	T1A	14.10.1970	3	RH	4	4R	Surrendered 19.11.1970
HOSKING / F / G	Winchester	Single Shot	3011	18.08.1970	P5A	18.08.1970	3	RH	4	4R	19.08.1970
DEMLER / W	Mossberg	Magazine Loaded	Model 40 1423	16.08.1970	H1A	18.08.1970	3 + 1 misfire	RH	4	4R	24.08.1970
MURPHY / T / A	Not Discernable	Single Shot	****	17.08.1970	P10B	18.08.1970	3	RH	4	4R very worn	19.08.1970
HARVEY / C / R	BSA	Single Shot	LC25770	03.09.1970	Mc2A	06.10.1970	3	RH	4	4R (hollow nosed)	02.12.1970
HARVEY / C / R	Mossberg	Single Shot	Model 25A 6130	03.09.1970	Mc1A	06.10.1970	3	RH	4	4R	10.12.1970
HARVEY / H / W	Winchester	Repeater Action	Model 63	02.09.1970	F2B	06.10.1970	3	RH	6	6R about 3/4 fatal	26.11.1970
SINCLAIR / E / W	Plinker	Single Shot	86190	02.09.1970	F1A	06.10.1970	3	RH	6	6R about 1/2 fatal	26.11.1970
EGLINGTON / A / D	Browning	Pump Action	FARIQUE	02.09.1970	F3B	06.10.1970	3	RH	6	6R similar but variation in lands. Set bullets at a same size land mark both on 51 - fail to disagree - some lines agree but could be chance. At 41 T is narrower, at 31 T narrower & has extra marks on edge. Excluded.	26.11.1970
Found Property (Western Springs Ak)	Savage	Single Shot	1319	07.09.1970	L1A	06.10.1970	3	RH	6	6R about 1/2 fatal	03.11.1970
McKAY / P / B	Plinker	Single Shot	61706	07.09.1970	CC1B	06.10.1970	3	RH	6	6R but 2/3 of fatal	04.12.1970

.22 RIFLE COLLECTION PHASE TESTING

Name	.22 Rifle	Type	Serial No.	Date Seized	Tag Number	Date Tested by Dr. Nelson	Test Shots Fired	RH Twist / LH Twist	Lands (Rifling)	Testing Comments	Date Returned
INNES / H / S	Springfield	Magazine Loaded	109	Sept	S1B	06.10.1970	3	RH	6	6R 1/3 fatal	23.11.1970
MASON / J / M	Remington	Pump Action	224533	Unknown	F1B	06.10.1970	3	RH	6	6R about 2/3 fatal	30.11.1970
EATON / A / J	Springfield	Single Shot	501	01.09.1970	G1B	06.10.1970	3	RH	6	6R about 1/3 fatal (hollow nosed)	24.12.1970
HODSON / J / J	Corroration	Magazine Loaded	JM	19.09.1970	G2B	06.10.1970	3	RH	5	5R	18.12.1970
HUGHES / E / J	Huntsman	Single Shot	Model 50	03.09.1970	M01B	06.10.1970	3	LH	6	6L 2/3 fatal	06.12.1970