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COMMONWEALTH OF MASSACHUSETTS

Norfolk, ss.

Superior Court  
Criminal Session.

.....  
Commonwealth of Massachusetts  
vs  
Nicola Sacco & Bartolomeo Vanzetti  
.....

Affidavit  
of  
Charles J. Van Amburgh

I, Charles J. Van Amburgh, duly sworn, on oath depose and say that I am the same Charles J. Van Amburgh who testified for the Commonwealth at the trial of said cases in June, 1921. And I am the same Charles J. Van Amburgh who since said trial has made affidavit which I understand was filed in connection with the hearing on the first supplementary motion for a new trial.

I have read and carefully considered the affidavit of Albert H. Hamilton filed in behalf of the defendants in said cases, and dated October 15, 1923.

In referring herein to said Hamilton affidavit I shall locate portions of said Hamilton affidavit by page number and paragraph number, and shall, so far as possible, refer to the various exhibits in these cases by using the same descriptive page numbers and letters which are used in the photograph album filed as an exhibit in connection with said Hamilton affidavit.

Page 4, paragraph 4

I do not agree with Mr. Hamilton that defects, rust pits, &c within the barrel, other than those occurring at the muzzle, cannot be used for identifying a bullet as coming from that particular barrel. From my experience I am absolutely certain that defects, rust pits, &c., when located within the barrel, if of such sufficient size or character, do make definite impressions on the bullet fired from said barrel, especially in the case of a metal jacketed bullet. The so-called mortal bullet (Exh.18) is such a metal jacketed bullet, and defects

and marks will be registered on such a bullet and will be visible either to the naked eye or through a microscope, depending, of course, upon the size of the defects and marks which have been registered. A metal jacketed bullet is harder and more resistant than a lead bullet, and has been shown by numerous tests to retain markings and scorings impressed upon it as far back as to be practically at the commencement of the rifling at the chamber end. It was from my knowledge of this fact, based on long experience, that I testified at the trial of these cases in reference to the tear or scoring appearing on said mortal bullet caused by a marked pitting and roughness of the barrel of the so-called Sacco pistol.

Page 17, paragraph 4.

*Begin 7* It is true that the firing-pin indentation or dent on the Fraher shell F4, and the three Lowell-Winchester shells, are not in perfect agreement as to location. The location of a firing-pin indentation does not prove that a certain shell was or was not fired from a certain gun. It is sometimes helpful, however, in connection with other objective signs, in determining this fact. The location of a firing-pin indentation made in different shells by the same firing pin will vary over a certain area, the center of which area may be called the center of impact. The reasons for such variation of location are,

(1) The tolerance between the firing-pin and the firing pin hole.

(2) The difference in the diameter of the cartridge and the chamber in which it is placed, which difference results in a certain looseness of the fitting of such cartridge in such chamber.

(3) The looseness of the fit of the slide, that is, that part of the pistol which houses or covers the barrel.

(4) The construction of the cartridge itself. Under the center of the primer surface is a hard anvil made of brass. When the firing-pin strikes the primer surface over this anvil there is a tendency of the firing-pin to be deflected to one side. In the Sacco pistol the space between the firing-pin and the firing-pin hole is .007 inch, which means that the firing-pin can move a distance of .007 of an inch within the circular rim of the firing-pin hole.

In a Colt automatic pistol the difference between the cartridge diameter and the diameter of the chamber, into which the cartridge fits, must not be less than .005 of an inch, in order to provide easy entrance of the cartridge into said chamber. This difference of diameter causes some play between the cartridge and the chamber. The slides of the Sacco pistol is very loose fitting and moves very noticeably when the receiver is grasped in one hand and the slide in the other. When ~~a movement~~ of the firing-pin within its rim, the cartridge within its chamber and the barrel combine in movement, there is a tendency to throw the point of impact of the firing-pin off center so far as the cartridge is concerned. These movements are demonstrable to anyone examining the pistol with a cartridge in place in the chamber. The action of the firing-pin when it strikes the primer surface above the anvil can, of course, not be shown in court, but the action of said anvil, above described, in throwing the firing-pin off center, is no less certain. The Court will perceive that the dents made in the primers of the Winchester <sup>and</sup> Peters shells known to have been fired in the Sacco pistol at Lowell, show a variation in location.

Inasmuch as all of these shells were fired from the same pistol, it is clearly demonstrated how slight evidence the location of the indentation is in the determination of the particular pistol from which a shell was fired. If it were possible to have a large number of shells for comparison I am convinced that the indentations would vary widely in location, although they would be within a certain area, depending on the factors I have above mentioned. *stop*

In reply to Mr. Hamilton's statement in said paragraph 4 on page 17, that the firing-pin indentation in the Fraher shell F4 is in the "exact center", microscopic measurements made by me prove that said indentation is .009 of an inch nearer the right edge of the primer surface than it is to the left edge.

In paragraph B on page 18 Mr. Hamilton states by inference that the difference in location of the firing-pin indentations on the so-called Lowell-Peters shells is accounted for by the difference in character of the primer used in said Peters' shells. As a matter of

fact, the character of the primer has nothing to do with the mechanical location of the firing-pin indentation, such location being governed by the considerations I have above set forth.

Page 18, paragraph 3.

In this paragraph Mr. Hamilton refers to a score or groove appearing near the end of the firing-pin in the Sacco pistol. This score may be seen without the aid of a microscope. On April 21, 1923, the firing-pin was photographed in my presence and under my direction at the Massachusetts Institute of Technology, and the resulting picture is hereto annexed and marked Exhibit A. This score was undoubtedly caused by the particular machine operation which formed the point of the firing-pin at the factory where said pin was made. It extends partly around the circumference of the pin at a distance .016 of an inch from the extreme end of the pin. The width of the score at its widest point is .0047 of an inch. The score of such a character is certain to register itself in the indentation made by the firing pin in shells fired from the Sacco pistol. I have examined microscopically the firing-pin indentations in the three Lowell-Winchester shells and in Fraher shell F4. In each of these indentations a sharp ridge raised above the general surface of the indentation is clearly outlined. Photographs of the firing-pin indentations on Lowell-Winchester shells Nos. 1, 2 and 3 and the Fraher shell F4 were taken under my direction and in my presence at the Massachusetts Institute of Technology on April 21, 1923. Copies of the pictures so taken are hereto annexed and marked respectively Exhibits B, C, D and E. In each of these pictures a distinct ridge is visible in the primer indentation on the left side of indentation, inasmuch as the objects in said pictures are transposed from left to right in the process of photographing, these ridges must be understood to be on the right side of the indentations. They are shown in the various pictures in the light spots in the indentations where the light was focussed upon them. The measurements of said ridges on said shells are as follows:

	<u>Length</u>	<u>Width</u>
Lowell Winchester #1.	.040	.0043
Lowell Winchester #2	.041	.0047

	Length	Width
Lowell- Winchester #3	.041	.0050
Fraher F4	.040	.0050

These ridges show irregular outlines of the two side lines, and the width measurements were taken at the point of the widest separation of said lines. The irregularity of outline, however, is similar in each ridge. The curve of each ridge is identical, and the measurements of length were taken along chord of the arc. I have ascertained from the ejector and extractor marks the exact position each shell occupied in the chamber of the pistol at the time it was fired. Having in mind the position of the score on the firing-pin of the Sacco pistol I am able to state positively that these ridges appearing on the three Lowell-Winchester shells and on Fraher shell F4 were caused by the score on the firing-pin of said Sacco pistol.

Page 19, paragraph 5.

Mr. Hamilton states that the chord measurement of the ridge on Fraher shell F4 is .60 inch in length, and later on page 20 states the chord measurement of the ridges on the three Lowell-Winchester shells is .25 inch in length. In fairness to Mr. Hamilton I must assume that said measurements were made not from the original shells but from the photographs appearing on either pages 12 or 16 of his photograph album. It is needless for me to suggest the chance for inaccurate measurements in dealing with these minute measurements when the photograph is relied upon, rather than the object itself.

I further examined the three Peters shells discharged by Captain Proctor at Lowell in the Sacco pistol. I found ridges in the firing-pin indentations of said Peters shells similar to the ridges found in said Winchester shells and said Fraher shell F4, although the ridges on said Peters shells were not as deep, long or wide as in the case of the other four shells. The reason for this is to be found in the fact that the Peters primers are of a different thickness, interior dimensions and design throughout than the Winchester primers. These differences, in connection with the possible variations in chamber pressure, account for the difference

in registration of firing-pin marks.

I have measured the depth of the firing-pin indentations in the three Lowell-Winchester shells and in Fraher shell F4, and find the respective depths of such indentation to be as follows:-

Lowell No. 1	-	.028
Lowell No. 2	-	.025
Lowell No. 3	-	.028
Fraher F4	-	.027 of an inch.

A score on a firing-pin, which, as on the Sacco pistol, is only .016 of an inch from the end of such pin, must therefore necessarily appear within indentations of the depth above described.

I have observed in the case of each of the four shells, that is, the three Lowell-Winchester shells and the Fraher shell F4, that the ridge in each case shows the lower side, looking into the indentation, as more abrupt than the upper side, which is a comparatively gentle slope. The crest of the ridge itself, in each case, is comparatively well defined, though not in the sense of being sharp. This characteristic, which does not clearly show and cannot be shown in photographs, but is visible through a compound microscope, is further evidence that the ridges referred to were all made by the same agency, that is, the firing-pin of the Sacco pistol.

Page 22, paragraph 1

It is true that the breech block of the Sacco pistol in its peculiarities of file marks and milling cutter marks possess a distinct individuality which should be registered on the sensitive primer surface of a cartridge fired in said pistol. When the firing-pin strikes the primer surface of the cartridge an explosion in the cartridge occurs. The expansion of powder gases immediately creates a chamber pressure varying in different cartridges between 9,000 and 15,000 lbs per square inch. This pressure causes the metal composing the primer surface to be forced back into vacancies or depressions directly in its rear. In the Sacco pistol such vacancies or depressions consist, first, of the chamfer or mouth of the firing-pin hole; second, of the score on the end of the firing-pin; third, of the cuts, scratches and marks on the surface of the breech block. The metal of the primer surface, which is forced back into the chamfer,

is called a flow-back or set-back. This flow-back or set-back is registered around the rim of the firing-pin indentation in the primer. The metal forced into the score on the firing-pin appears, as has already been described, as a ridge in such indentation. The marks on the surface of the breech block are registered correspondingly on the primer surface between its rim and the firing-pin indentation, all of these marks depending as to clearness on the pressure exerted at time of firing, furnishing real evidence as to the identity of the pistol from which the cartridge is fired.

I have caused photographs to be taken of the primer surfaces of the three Lowell-Winchester shells and of Fraher shell F4, but, in view of the excellent pictures submitted by Mr. Hamilton, feel that it is unnecessary to annex the said photographs to this affidavit. These pictures appearing on pages 12 and 16 of his photograph album, combined with microscopic measurements of the markings registered on the primers of the shells so photographed, are extremely important in determining whether Fraher shell F4 was fired in the Sacco pistol.

Page 23, paragraph 5.

Reference is there made by Mr. Hamilton to the ~~right-angled~~ <sup>rectangular</sup> prominence appearing at the top center of the primer of Lowell-Winchester shell No.3, and the absence of such prominence on the primer of Fraher shell F4. The reason that Mr. Hamilton fails to find such rectangular prominence on Fraher shell F4 is because such prominence is a registration of a mark on the breech block of the Sacco pistol, which, by reason of its distance from the firing-pin hole, is excluded from the picture made on the primer of said Fraher shell. This prominence I find on microscopic examination to be distant .0363 of an inch from a fixed point of reference taken by me, to wit, a prominent spot standing out clearly from the general surface and having a knob-shaped appearance located at the 12 o'clock section of the rim of the firing-pin indentation, almost directly beneath said rectangular prominence. In Lowell-Winchester shell No.2 the same point where said rectangular prominence should appear is practically covered with verdigris and is scarcely discernable. In Lowell-Winchester shell No.1 the lower portion of said rectangular prominence is visible, but not so clearly as in the case of No.3. In each of said other Lowell-Winchester shells, to wit, Nos.1 and 2,

measuring from the same fixed reference point on each, as in the case of Lowell-Winchester shell No. 3, there is more than .0363 of an inch distance between said reference point and the outer edge of the primer. In the case of Fraher shell F4 there is less than .0363 of an inch between the similar fixed reference point and the outer edge of the primer on said shell. By reason of the fact that the firing-pin indentation of said Fraher shell is nearer the center of the primer surface than the indentation is on any of the Lowell-Winchester shells, said distance of .0363 of an inch measured from said fixed reference point on said Fraher shell carries one beyond the outer edge of the primer surface and into the vacancy formed by the junction of the primer and shell. In other words, by reason of the location of the firing-pin indentation in the Fraher shell the field of the breech block pictured on the primer surface of said shell, above said indentation, is smaller than such field on the three Lowell-Winchester shells, and does not include this mark described as a rectangular prominence.

On Page 24, paragraph 1

Mr. Hamilton <sup>suggests</sup> ~~says~~ a knife blade experiment through the center of the indentations on the three Lowell-Winchester shells and the Fraher shell F4, and states that he finds more flow-back to the left of his knife blade in each of the three Lowell-Winchester shells than there is to the right, but that in the case of the Fraher shell, all as shown on the photographs on page 12 of his album, the flow-back is equal in extent all around the firing-pin indentation. I have made the experiment suggested by Mr. Hamilton and find that the flow-back on the Fraher shell as shown by his said photographs appears the same on said shell as it does on the three Lowell Winchester shells. I have further examined, microscopically, said flow-back on these four shells and find it to be, in general, the same in appearance and location on all.

Continuing on page 24, Mr. Hamilton calls attention to the extra amount of flow-back at the top edge of the primer surface on Lowell-Winchester No.3, which he calls V-shaped, and describes said extra amount of flow-back on Fraher shell F4 as wedge-shaped. Mr. Hamilton states that from the top of said V on Lowell shell No.3 there extends a W-shaped set of file marks extending to the bottom

of the rectangular elevation above mentioned, which said elevation he states appears at the middle of the said W-shaped file marks. He further says that extending upward from the wedge on F4 there is a V-shaped set of file marks. On careful microscopic examination I find that there extends up from the respective knobs of the flow-back on these two shells (which he describes respectively as V and wedge-shaped) V-shaped file marks. The file marks extending on Lowell-Winchester shell No.3 from said V-shaped extra amount of flow-back is not a set of file marks in the shape of the letter W, but will be perceived to be a set of file marks that are V-shaped, just as they are in the case of the Fraher shell F4.

Beginning at the paragraph at the bottom of page 24 Mr. Hamilton refers to the letter Y on Fraher shell F4 and Lowell-Winchester shell No.3, giving the difference in measurements in the lengths of the respective stems and the sides of said inverted Y's. The difference in the length of the lines going to make up these Y's is of no consequence, owing to the possibility of the breech block and slide as a unit having moved either vertically or horizontally on the part to which it is assembled, namely, the receiver. A trial of this by grasping the receiver in one hand and the slide in the other will serve to demonstrate that the slide is very loosely united to the receiver. That there was such variation in the length of the three lines going to make up the inverted Y's made by the Sacco pistol on the three Winchester shells discharged therein at Lowell, on the same day, and in succession, is shown by the fact that the lines making up the V-shaped portion of the inverted Y are longer on Lowell-Winchester shell No.3 than they are on Lowell-Winchester shell No.1. The shortness of the V-shaped portion of the letter Y on Lowell-Winchester shells Nos. 1 and 2, as compared with Fraher shell F4, is further accounted for by the same reasoning set forth above in describing the absence of the rectangular prominence on Fraher shell F4.

I find on Fraher shell F4 the same minute parallel line marks extending northeasterly from the bottom of said inverted Y that Mr. Hamilton describes at the bottom of page 24 as appearing at the bottom of the inverted Y in Lowell-Winchester shell No.3.

With reference to the number of file marks between the left margin of the primer and the said inverted Y, I find there are as many such file marks in said area on Fraher shell F4 as on Lowell-Winchester shell No.3. The difference in prominence of said marks, and in fact of all marks on Fraher shell F4 and Lowell-Winchester shell No.3 is due to the fact that the impressions on Fraher shell F4 are much more distinct than they are on Lowell-Winchester shell No.3. This increased prominence is attributable not to the coarseness of the file marks on the breech block but to the depth to which they extend, owing to the difference in chamber pressure at time of firing in the cartridges of which these respective shells were a part.

Referring to the last paragraph on page 25 and the whole of page 26, with the exception of the last two lines, the differences stated by Mr. Hamilton as to lengths of line, comparing Fraher shell F4 and the Lowell-Winchester shells, are all accounted for by reasons already stated, that is, the change in location of the breech block from shot to shot, due to the looseness with which it is united to the receiver. On Lowell-Winchester shell No.2 there are intersecting lines at the lower extremity of the inverted V, referred to by Mr. Hamilton, at the same distance from the apex of said V, as in the case of Fraher shell F4, to wit, at a distance of .0469 of an inch. These intersecting lines, however, are not so distinct on said Lowell-Winchester shell as in the case of Fraher shell F4, because of the difference of chamber pressure in the two cartridges at the time of explosion. The same lines appear to the right of the V in Fraher shell F4 as appear to the right of the said V in Lowell-Winchester shell No.2, the most notable of said lines being the long line, with a considerable number of smaller and less noticable lines on either side.

On Lowell-Winchester shells Nos. 2 and 3 one line of considerable length appears still further to the right, being the second well defined line to the right of said V, which line does not appear on Fraher shell F4. The reason for the absence of this second well defined line on Fraher shell F4 is due to the fact that the breech block impressions are registered farther to the left in Lowell-Win-

chester shells Nos. 2 and 3 than in the case of Fraher shell F4, for the reasons previously given. As illustrative of what I mean, I find that the Sacco pistol, which fired Lowell-Winchester shells Nos. 1 and 2 on the same day, registered breech block imprints on their primers which vary in the fields shown. My measurements in reference to this undoubted fact show as follows: On Lowell-Winchester shell No.1 the distance from the intersection of the inverted Y, on the left hand side of the primer, to the extreme left edge of the primer itself, is .0313 inch. On the right side of the same shell the distance from the apex of the inverted V to the right edge of said primer is .0229 inch. On Lowell-Winchester shell No.3 the distance from the intersection of the inverted Y to the extreme left edge of the primer is .0254 of an inch. On the right side of this same shell the distance from the apex of the inverted V to the right edge of said primer is .0309 of an inch.

The difference which Mr. Hamilton notes as to the width of flow-back on the pictures of the four shells on page 12 is perhaps accounted for by pointing out to the Court that the shells shown in these four pictures are not uniformly mounted. Fraher shell F4 should be revolved slightly to the right in order to have its position with reference to its extractor and ejector marks similar to the position of the three Lowell-Winchester shells. The difference as to width of flow-back at given points on different discharged shells fired from the same pistol is of little consequence, because, by reason of the tolerance between the firing-pin and the firing-pin hole. There is an ever-changing space around the firing-pin into which the metal of the primer will flow. The width of flow-back on shells fired from the same pistol, therefore, necessarily varies from shot to shot.

Because of such variation in the width of flow-back on shells fired from the same pistol it is unsafe to measure from any point on such flow-back, as a reference point, to determine the respective distances of other marks on the primer surface from such flow-back or from each other.

I have examined Fraher shell F4 and Lowell shell No.3 as to the areas described in the first paragraph on page 27. Under the

microscope the same lines in this area appear on both shells except that on Lowell shell No.3 they are more lightly registered, due to the reason I have given, to wit, the difference in chamber pressure.

In Paragraph 2 on page 27

Mr. Hamilton notes certain differences in the lines on the primer surfaces and attributes these differences to the difference in files used in the breech block finishing. These differences, in my opinion, are attributed <sup>able</sup> not to different file marks on different breech blocks, but to a variation of chamber pressure in the respective cartridges, which has caused the same file mark to be registered lightly in one case and more heavily in the other case.

I have examined under the microscope the marks on Lowell-Winchester shell No.3 and Fraher shell No.4, to which Mr. Hamilton refers in the bottom paragraph on page 27. I find in the locations referred to by him on the two said shells the same type of marks on both shells, but more marks on the Fraher shell, due to the greater chamber pressure, as hereinbefore stated. All the marks, however, appear <sup>ing</sup> in the area mentioned on Lowell-Winchester shell No.3 appear in the corresponding area on Fraher shell No.4.

I have hereinbefore called <sup>to the</sup> attention of the court the similarity of identifying breech block impressions on the three Lowell-Winchester shells and on Fraher shell F4, where Mr. Hamilton states there is a difference. It is now important to call to the attention of the Court certain identifying similarities of the breech block impression on Fraher shell F4 with the breech block impressions on some one or more of the Lowell-Winchester shells fired through the Sacco pistol during the trial. In describing the location of these identifying similarities I shall refer to the pictures as shown by Mr. Hamilton on pages 12 and 16 of his photograph album.

(1) A measurement was made of the inverted V on the right side of the primer on the Fraher F4 shell and the inverted Y on the left side of the same. The distance between the apex of the V and the junction of the converging lines of the letter Y is .1245 inch. Measuring between the same points on the L3 shell I find the distance to be .125 inch, and between the same points on

the L1 shell .124 inch. I have not made similar measurements on shell L2 as it is covered with verdigris on the left side to such an extent that it is impossible of measurement.

(2) A measurement was made on shell F4 from the point of intersection of the two converging lines of the V on the right of the firing-pin indentation to the long vertical line next to the right of this point, and was found to measure .012 of an inch. In measuring the same distance on the Lowell shell No. 3 it was found to measure .012 of an inch.

(3) A measurement was made on shell F4 from the point of intersection of the two converging lines of the inverted V, at the right of the firing-pin indentation, to the long vertical line to the left of this point, and was found to measure .011 inch. The same measurement on Lowell No.3 shell was found to be .011 inch.

(4) A measurement was made on shell F4 from the long vertical line, last above referred to, to the next vertical line on its left, above the firing-pin indentation, and intersecting the edge of the flow-back at 2:30 o'clock. This measurement was found to be .007 inch. The same measurement on Lowell shell No. 3 was found to be .007 inch.

(5) A measurement was made on shell F4 from the stem of the inverted Y, at the left of the firing-pin indentation to the next line to the right, a line above the firing-pin indentation and intersecting the edge of said indentation, at about 9:30 o'clock. This measurement was found to be .010 inch. The same measurement made on the Lowell shell No.3 showed the distance between these two lines to be .0105 inch.

(6) At the top of the firing-pin indentation on shell F4, at 11:30 o'clock, appears a prominence

or extra amount of flow-back which has flowed into a notch in the breech block. This prominence on shell F4 measures .0045 inch. The same prominence or extra amount of flow-back on the Lowell shell No.3 measures .0050 inch.

(7) To the right of the above mentioned prominence, at about 1:30 o'clock, on the rim of the flow-back appears another prominence of somewhat similar nature, measuring from the prominence at 11:30 o'clock to the prominence at 1:30 o'clock, on shell F4, about .0220 inch. A measurement between the same two points on Lowell shell No.3 shows the distance to be .0225 inch.

(8) At the top of the firing-pin indentation is a vertical line extending from the top of the primer downwards, intersecting the edge of the flow-back, at about 1:30 o'clock, with another similar line parallel thereto and to the right thereof, intersecting the edge of the flow-back at about 2 o'clock. The distance between these two lines on shell F4 measures .0082 inch. The distance between the same two lines on Lowell shell No.3 measures .0080 inch.

On page 28, paragraph 1, reference is made to a statement by Mr. Hamilton that where a number of cartridges are fired in the same pistol the ejector mark on the head of each shell should be the same.

I have examined microscopically the shells shown on pages 12 and 16 of the photograph album with especial reference to ejector marks thereon, said shells being F 1 and Lowell-Winchester's Nos. 1, 2 and 3.

The ejector mark on shell F4 is very well defined and shows the outline of an ejector which is of the shape of a right angled triangle. Shell L3 also shows, in the same location as that of F4, a well defined ejector mark of the shape of a right angled triangle. The appearance of this mark on L3 agrees with that found on shell F4 as to appearance and location. Shells L 1 and L2 show ejector marks which are not clearly outlined, although

their location agrees in general with locations of F4 and L3. When a number of cartridges are fired in the same automatic pistol they will not show identically the same ejector impressions, for the reason that when the slide moves to the rear, as is the function of the slide in an automatic pistol at the time the cartridge is discharged, the fired shell is withdrawn from the chamber by the extractor hook, which in the case of a Colt automatic pistol is on the upper right side, and its tendency is to press the shell toward the left where it has poor support. A shell is in almost every case held very loosely, for the reason just stated, and the clearness of the impression which it will receive from the ejector is dependent upon the position it is in at the instant it strikes the ejector when the slide has approached the limit of its stroke to the rear, and to the firmness with which it is held by the extractor

Page 34, paragraph 3.

Mr. Hamilton makes reference to the Colt Automatic Pistol Company factory. It is believed that he means the Colt's Patent Fire Arms Company, Hartford, Connecticut. The method of rifling a pistol barrel at the said last mentioned factory isto make use of a rifling machine which is specially designed for rifling gun barrels. The degree of pitch, sometimes known as "twist", having been determined, the machine is set to the desired point and the operation is carried on through the medium of a rifling rod which moves forward and back, and which has on its forward end a rifling head containing a rifling cutter. The rifling cutter is ground and honed to the desired shape, which shape determines the contour of the grooves which are cut in the pistol barrel. It is not the practise to complete one groove in the pistol barrel before moving to and commencing the next one, but rather to commence the cutting of each groove with a very light cut and to move progressively with similar light cuts to all the grooves in the barrel, cutting each groove deeper and deeper and so continuing round and round until sufficient groove depth is reached, after which the rifling tool is withdrawn. The method of rifling the barrel which I have described is one which produces a groove of uniform width throughout a given barrel. Uniformity in groove and land dimensions in a given

barrel is absolutely necessary to obtain accurate shooting. I know it to be a fact that the Colt Company produces weapons all of which are noted for their accuracy. The system of rifling described by Mr. Hamilton would admittedly produce a barrel with non-uniform grooves, would destroy its accurate shooting qualities, and is not the method employed by said company.

Measurements of the width of lands and grooves in the Sacco pistol, on the mortal bullet and on the three Lowell-Winchester bullets have been made and submitted by Mr. Hamilton and Mr. Gill. It is apparent that the measurements of Mr. Hamilton and Mr. Gill do not agree with each other. It is also apparent that their measurements of the Lowell-Winchester bullets do not agree with their measurements of the Sacco pistol. I have carefully made measurements of the lands and grooves of the mortal bullet and submit them as follows:-

<u>Land width</u>	<u>Groove width</u>
.0533	.1039
.0544	.1045
.0543	.1036
.0534	.1050
.0524	.1032
.0532	.1047

I have also made careful measurements of the width of the lands and grooves of one of the Lowell-Winchester bullets, and submit them as follows:-

<u>Land Width</u>	<u>Groove width</u>
.0529	.1058
.0531	.1047
.0535	.1047
.0537	.1050
.0522	.1068
.0507	.1054

I have carefully measured the width of the lands and grooves in the Sacco pistol which I submit as follows:

<u>Land width</u>	<u>Groove width</u>
.0527	.1056
.0505	.1050
.0525	.1058
.0507	.1050
.0519	.1058
.0523	.1059

Average width of mortal bullet land is .0535

Average width of Lowell-Winchester land .0527

Average width of Sacco pistol land .0517

Average width of mortal bullet groove .1041

Average width of Lowell-Winchester groove .1054

Average width of Sacco pistol groove .1055

Total width of lands and grooves in mortal bullet, .9459

Total width of lands and grooves in Lowell-Winchester bullet .9485

Total width of lands and grooves in Sacco pistol, .9437

It is apparent again that my measurements of the lands and grooves in the Lowell-Winchester bullet known to have been fired from the Sacco pistol, do not absolutely agree with my measurements of the Sacco pistol. Nor do my measurements of the mortal bullet absolutely agree either with my measurements of the Lowell-Winchester bullet or with my measurements of the Sacco pistol. The closeness of my measurements of the mortal bullet, however, to both the measurements of the Sacco pistol and the measurements of the Lowell-Winchester bullets are significant in identifying the said mortal bullet, first, as having been fired in the Sacco pistol, and, second, as being alike in reference to width of lands and grooves with the Lowell-Winchester bullet known to have been fired in the Sacco pistol. Measurement of land and groove widths through a microscope depend for their accuracy, first, upon the eye-sight of the examiner; second, on his manipulation of the examining instrument or microscope; and, third, on the examiner's familiarity with the construction of bullets and pistol barrels, with particular reference to the land walls of such barrels and the groove contours; and, fourth, on the condition of the pistol barrel and bullets when measured.

The land walls of a pistol barrel, which also form the boundaries of the grooves, do not have parallel sides, but slope from the top of the lands to the base of the grooves, this condition being necessary to give the rifling cutter a clearance. The land walls at their base are also slightly rounded where they intersect the grooves. These

sloping land walls necessarily impress their character on the bullet fired through the barrel. In order to obtain as correct a measurement as possible of a land or groove width either in barrel or on bullet, measurements should be taken from a half-way point on a land wall or groove wall to the correspondingly half-way point on the opposite land wall. If the person making the measurements does not accurately obtain the proper point on the land wall from which or to which to measure the resulting measurement will be either too large or too small. The person measuring also encounters defects in the shape of rust, pitting and fouling, which prevents, in many instances, the obtaining of a true measurement. I am now referring to measurements made with a microscope and Filar micrometer eye-piece.

The most accurate method of obtaining the bore diameter of a barrel and from the bore diameter computing the bore circumference is by the use of a plug guage. This is a purely mechanical method of measurement and is absolutely accurate. Measuring the Sacco pistol with such plug guage, the true bore diameter is found to be .3045 inch. Multiplying this bore diameter by the usual constant, the true circumference of the bore is obtained, which is .9556 inch. Comparing this figure so obtained with the total width of lands and grooves in the Lowell-Winchester bullet, obtained by microscopic measurement, there appears to be a difference of .0071. Comparing again this figure with the total width of lands and grooves obtained by microscopic measurement of the mortal bullet, there appears to be a difference of .0097. Comparing again the total width of lands and grooves of the Lowell-Winchester bullet, obtained by microscopic measurement, and the total width of lands and grooves on the mortal bullet, obtained by such measurement, the difference is .0026.

Upon page 37 Mr. Hamilton suggests as a graphical demonstration of the difference between the widths of the lands and grooves on the mortal bullet and in the Sacco pistol, that his two positives filed on pages 10 and 11 should be placed one upon the other and compared. On placing bullet cut numbered 1 on land numbered 1 of the pistol, both measuring .050, the land cut on the bullet appears to be less in width than the land in the pistol. Again placing the land and

land cut numbered 11 together, one of which is stated to measure .50, and the other, .0475, they are apparently of the same width. Again taking groove No.12 on both bullet and pistol, one measuring .1025 and the other .1050, they appear to fit with each other. Whether these apparent discrepancies mean error in the making of the measurements or in the graphical expression of the measurements I am unable to state.

In reference to the paragraph at the bottom of page 37 and and at the top of page 38, it appears that some of the lands on the Lowell-Winchester bullets, the Lowell-Peters bullets, and the mortal bullet have a so-called double land at the top. This double land is caused by what is termed "slippage". The slippage in each instance is shown at the right of the true land cut. Where a pistol barrel has a left twist as has the Colt automatic pistol, slippage when it appears on the bullet fired in such pistol is always to the right of the true land. It is caused by the bullet jumping ahead when the explosion occurs, and momentarily failing to take the rifling. The bullet "staggers", as it is sometimes called. As the rifling takes effect the bullet proceeds in its normal course to the left and with the twist of the rifling, but the initial impression of its jump ahead is registered at the top of the bullet and slightly to the right of the true land-mark. This slippage or registering of a double land-mark commonly occurs in the firing of automatic pistols. The appearance of such mark on bullets so fired is not significant in this case.

This double land-mark is made by the land in the pistol. The top surface of the land is formed by the action of a reamer which rotates in its journey through the barrel, and its action leaves a series of fine machine tool marks running transversely across the surface of the land. These tool marks permit the collection of metallic fouling or scraping from the surface of the bullet jacket through abrasion as the bullet proceeds through the barrel. The condition of the land varies accordingly from shot to shot, and scratches or marks made by the land upon the bullet, as are referred to by Mr. Hamilton in this case, have, in my opinion, no consequence.

I have heretofore remarked that the clearness of the lines on the different primer surfaces of the Lowell-Winchester shells and the Fraher shell F4 depends to a certain extent on the chamber pressure existing at time of firing. This chamber pressure is the force which thrusts the cartridge back against the breech block and firing-pin. The force with which it is thrust backward is affected by the friction encountered in the chamber. The greater the friction encountered the less the force of the backward thrust. The presence of oil in the chamber or on the shell lessens the friction and increases the force of the blow, and conversely the absence of oil in the chamber or on the cartridge increases the friction and lessens the force of the blow. When the Lowell-Winchester shells were fired through the Sacco pistol at Lowell at the time of the trial said pistol had not been oiled and had been stored for a period of approximately a year. At the time of the shooting at South Braintree, presumably the pistol was being kept by its owner in working condition. If it were so kept there would be a certain amount of oil in the chamber of the pistol. If this inference as to the relative condition of the pistol at South Braintree and at Lowell is warranted, it would assist in explaining the greater force with which the Fraher shell F4 was thrust back at the time of the firing and the lesser force with which the Lowell-Winchester shells were thrust back at the time they were fired.

I am absolutely certain that the Fraher shell F4 was fired in the Sacco pistol. The score of the firing-pin in the pistol is registered in the firing-pin indentations in the Lowell-Winchester shells and in the Fraher shell F4. The impression of the breech block of the Sacco pistol is clearly shown on the primer surfaces of the Lowell-Winchester shells and of Fraher shell F4. Not only do the photographs taken of these marks on the shells demonstrate these facts, but microscopic measurements show the same relation of the lines on the primer surface of Fraher shell F4 to each other as the relation of the lines to each other on the primer surfaces of the Lowell-Winchester shells.

I am also positive that the mortal bullet was fired in the Sacco pistol. The marks in the groove cut, to which I testified

at the trial, and which I then showed to the jury, were caused by pittings and corrosion in the barrel of the Sacco pistol. Since the trial I have made an exhaustive microscopic examination of the mortal bullet, of the three Lowell-Winchester bullets, and of the barrel of the Sacco pistol. These examinations were made, as I have above stated, with the aid of a compound microscope with a Filar micrometer attachment. This is a much more powerful microscope than the smaller one which I used at the time of the trial. The microscopic measurements which I have made of the land and groove widths in the pistol and on the bullets are extremely significant. The facts which I have found from my entire investigation are so clear that, in my opinion, they amount to proof.

Charles J. Van Amburgh

STATE OF CONNECTICUT

Fairfield County ss.

Bridgeport, October 24<sup>th</sup>, 1923.

Signed and sworn to before me on date above given.

My commission  
Expires Feby 1-1928  
J. N. S.

John N. Standish  
Notary Public

State of Connecticut  
COUNTY OF FAIRFIELD  
County Clerk's Office. }

I, FRED W. TRACY, Clerk of said County and of the Superior Court in, and for said County, the same being a Court of Record, having by law a seal, hereby certify

That John N. Standish whose name is subscribed to the certificate of proof, acknowledgment, or affidavit of the annexed instrument, and thereon written, was, at the time of taking such proof, acknowledgment or affidavit, a Notary Public, ~~Commissioner of the Superior Court, Justice of the Peace,~~ within and for said County, residing in said County, duly appointed, commissioned and sworn, and authorized by the laws of said State, to administer oaths, and take the acknowledgments and proofs of deeds or conveyances for lands, tenements and hereditaments, in said State, and other instruments to be recorded therein, and to certify the same; that full faith and credit are and ought to be given to his official acts; and I further certify that I have compared the signature to the original certificate with that deposited in this office by such person and verily believe that the signature to the attached certificate is his genuine signature and said certificate is not required to be under seal, and the person signing such certificate is not required by law to file in this office an impression of his official seal.

In testimony whereof, I have hereunto set my hand and affixed the seal of said Court, at Bridgeport, in said County and State, on the 24<sup>th</sup> day of October 1923

Fred W. Tracy Clerk.

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Commonwealth

vs.

Sacco and Vanzetti

#5545

#5546

Counter-

Affidavit of

Charles J. Amburge

(5<sup>th</sup> motion)

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OCT 25 1923

OFFICE OF CLERK OF COURTS  
NORFOLK COUNTY

