#9

A REVIEW

OF THE

Second Trial of Jesse Billings, Jr.,

FOR THE

MURDER OF HIS WIFE.

TRIED AT THE SARATOGA OYER AND TERMINER,
BALLSTON, SARATOGA COUNTY,
APRIL, 1880.

Being Chiefly a Review of the Medical Testimony,

BY

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SYRACUSE:
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A Review of the Second Trial of Jesse Billings, Jr., for the Murder of His Wife: Tried at the Saratoga Oyer and Terminer, Ballston, April, 1880, Mr. Justice Porter Presiding: Taking Chiefly into Consideration the Medical Evidence and the Bearing it has upon Medical Jurisprudence.

In the hamlet of Northumberland, Saratoga county, on the evening of the 5th of June, 1878, the time about half past eight in the evening, while sitting in front of a window, a lighted lamp upon the table before her, Mrs. Jesse Billings, Jr. was shot, dying instantly from the effect of the bullet. The window shade was pulled up about one-third the height of the window, and the shot entered the glass about seven and one-half inches (19 cms.) from the bottom of the sash, and two and one-half inches (6.3 cms.) to the left of the central stile, as looked at from without in. Mrs. Billings was sitting about three feet (91 cms.) from the window. Upon being raised from the floor to which she had fallen, a wound of entrance was found on the left side, above the meatus auditorius externus about one-half an inch, (13 mm.) and another wound larger in size, on the right side back of the ear. An autopsy was made by Dr. F. Gow, the coroner, assisted by Dr. C. S. Grant, of Saratoga Springs. The head only was examined, and the cause of death pronounced gun-shot wound of the head. The coroner's inquest followed, and as a result Jesse Billings, Jr. was arrested and held to await the action of the grand jury. He was indicted and tried for the crime at the Saratoga Oyer and Terminer, held at Ballston, October, 1878. The trial resulted in a disagreement of the jury, eleven standing for acquittal and one for conviction. Mr. Billings was released from custody on bail, and again tried for his life in April, 1880.

Not being fully satisfied with the autopsy first made, the people's counsel had the body raised, and requested Dr.

John Swinburne, of Albany, to make a further examination of the head. The cause for this act was the claim, on the part of the defense in the first trial, that *all* the lead fired at the murdered woman was found by the physicians holding the first autopsy, and the people wished to know whether more lead did not remain in the skull. Dr. Swinburne removed the head from the trunk, taking only the bones of the skull, sawing through the external angular processes and the anterior roots of the zygomatic arches. After maceration the skull was cleaned, careful search being made for any particles of lead, none however being found, and the broken bones wired together. The skull so prepared was put one side, and produced in evidence at the second trial. A brief summary of the evidence, for and against, may give a clearer idea of the medico-legal question upon which the experts were called to decide.

The people claimed that they proved: That Jesse Billings, Jr., the husband of the murdered woman, alone had a motive for wishing her death. That he had twice before threatened her life,once by chloroform and once by arson. The morning after the murder, footprints were found in the flower beds in the yard. These were traced from there to a fence dividing the Billings yard from a garden belonging to the next neighbor, a person by the name of Reed. Still following these tracks, they led through this fence, some little distance in the Reed garden, again over the fence through an orchard, and a cornfield as far as a lane on the other side of the field. Here was a gate, known as the "Red Gate," and evidences were found of a horse and wagon having been hitched there for some little time. From this point the tracks led to an old unused well in a meadow the other side of the lane. From the old well they led back again to where the horse was tied, and there ended. Where the footprints were clear and distinct in the soft earth of the flower beds, they corresponded to the rubber boots worn by the prisoner the night of the murder. This the people claimed they showed clearly, for the "frog" on the sole of the boots was peculiar, and a like mark was found in the tracks. The tracks further showed the maker to be in haste, and yet a listening haste, for at one point near where they left the Reed garden and passed into the orchard, the person making them evidently stopped to listen, and then

resumed his flight. Though carefully searched for, no weapon was found at first, until some one suggested to examine the old well. This well was known only to a few, it having been long in disuse, and merely covered by loose boards. It was searched, and from it drawn up a gun, a Ballard carbine of the old pattern, which three witnesses swore they believed to belong to Jesse Billings. In their belief it was the same weapon that much looking had been done for, as for a long time it had been lying about in Mr. Billings' store and after the murder could not be found, until the officers drew it from its hiding place in the old well. In the chamber of the carbine was an empty shell, proved on the trial to belong to the make of cartridges known as the "commercial long 44." This gun became an important feature in the case, and much of its bearing as to the question, "was it the weapon?" was referred to the medical experts.

The prosecution further showed that an ordinary man would have had time to do the murder, run the distance claimed, drop the gun in the old well, take the wagon at the Red Gate, drive to Squire Washburne's, the place where Billings claims he was when his wife was shot, and still reach this Squire Washburne's at the time the prisoner said he did. The people further showed that Billings admitted he was out on his farm that night, to salt his sheep and repair some fences, so the cattle should not stray, and that while doing this he had his horse hitched in the lane. It was also clearly proved that the cattle could have easily strayed to the main road for the gate was left open, Billings himself stating before the coroner that *he did not shut it in his hurry.* The conduct of the prisoner was such as to call for careful scrutiny. When told the fact that his wife had been injured, he answered in words indicative of knowledge not only as to the kind of injury, but also its result. Upon reaching his home, his daughter accused him of the murder almost in so many words. He took no measures to find the murderer. When officers proposed methods of search, he advised delay, stating the whole affair was a conspiracy to ruin him. Another fact was brought out: A dog belonging to the family was in the house at the time of the murder. This dog was in the habit of barking whenever strangers or others than the family approached the house. It did not bark the

evening Mrs. Billings was shot. The servant-maid testified Billings said to her, "*that shot went where it was intended*," and the people claimed he knew what he was talking about. Upon these several main points the case for the people went to the jury.

In defense an alibi was sought to be established. The tracks were disputed. The time Billings reached Washburne's was made a special and strong point, and that the time was so short between the firing of the shot and of the prisoner's being at Washburne's that it was utterly impossible for him to have committed the murder. That a man was seen in rapid flight, going from the scene of the killing, down the tow-path, that this man was seen running from near the house just after the shot was fired, and that a hat produced in court and found on the tow-path was the one worn by the fleeing murderer.

The defense in the first trial claimed that all the lead fired was found in Mrs. Billings' head. In the second trial, however, the same claim was not made, but that it was a smaller ball than a "44," and its full weight less than 220 grains (14.256 gm.) That in consequence the Ballard carbine could not have been the gun from which the shot was fired; for it not only called for a "44" ball, but would throw a bullet with such force that it necessarily must have gone entirely through the head. They further claimed powder marks and grains of powder to have been found in the window-sash, showing the weapon to have been near the wood-work, and that the hole in the glass was not large enough to admit a full-sized 0.44 of an inch ball. Upon these general points the defense went to the jury and won a verdict.

It will be seen that each side laid stress upon the character of the weapon used; one claiming it to be the Ballard carbine produced; the other that it was a pistol. The question was for the medical experts to answer: What would be the effect upon the skull from the firing of a 44 calibre ball from a Ballard carbine, the ball weighing 220 grains (14.256 gm.) being propelled by 28 grains (1.814 gm.) of powder? Another: What would be the effect upon the ball? To these two main questions, clearly ones for a medico-legal jurist, others were added not belonging to medicine but to general knowledge.

In answering the first question propounded, much naturally depends on the part struck by the ball, but in this case we can only consider the effect when the ball strikes various parts of the head, in comparison with the effect produced on the Billings' skull. Starting out with the proposition that we are dealing only with a 44 calibre ball weighing 220 grains, (14.256 gm.) having 28 grains (1.814 gm.) of powder, being fixed ammunition, such as is known as the "44 long commercial cartridge," manufactured by the Union Metallic Cartridge Company, of Bridgeport, Conn., I will not take the time to speculate what might be the effect were the bullet of less size and weight; but leave that question to inference. That this is the ball we have to do with, is proven by Mr. Leet, of the Union Metallic Cartridge Company, who testified to the shell taken from the carbine and the ball taken from Mrs. Billings' head, as, in his opinion, being of the character referred to. Mr. Leet could not find upon the ball the "lands and grooves" or the marks of the rifling of the gun, but from other characteristics was positive the ball was a "44 long."

Mr. Hepburn, of the Remington Rifle Works at Ilion, N. Y., testified that he, also, believed the ball a "44." He could not find the lands and grooves, but the heel of the ball and the lines and scratches upon it showing a left-handed twist to the barrel from which it was fired, served, in his opinion, to draw the ball taken from Mrs. Billings' head into the Billings carbine; for this left-handed twist is peculiar to this make of rifles.

First-Lieut. Charles C. Morrison, of the United States Ordnance Corps, also testified to his belief that the Billings bullet was of 44 calibre.

Mr. Lewis, of Troy, N. Y., did not think it of such size. He was one of the defendant's experts; but another expert on the part of the defense, Professor Jacob S. Mosher, of Albany, *did*, by actual measurement fix the size of the ball. Mr. Lewis and Dr. Mosher both found what they considered to be, and swore to as, the "lands and grooves," and so distinctly that they could accurately measure them. Dr. Mosher did thus measure, and when announcing the result, gave first of all the ball to be of 36 or 38 calibre, but shortly corrected himself, for he found some slight errors in his calculations,

and the corrected statement proved the claim of the people, that the ball was a "44." Although Dr. Mosher later in the trial again changed his mind as to size, still his own careful measurement of the "lands and grooves," he could so clearly point out, could only make the ball one that was able to fit and be fired from the Billings' gun. It is fair to assume then when experts on bullets, men whose whole business has lain for years with fire-arms and ammunition, swear that this ball was of .44 calibre, and Dr. Mosher, who also testified to a large and varied experience with fire-arms, finds by actual measurement the ball *to be* a .44, that Mr. Lewis, of Troy, was mistaken when he thought it was not of that calibre.

The defense maintained it could not be a ".44." The hole in the window pane showed that. Both of the experts for the defendant believed a ball could not make a smaller hole than itself when passing through glass. This supposes that the ball after being fired is of the same calibre as before, for the one fired if striking any substance harder than itself is necessarily upset, is incapacitated from being used to test the hole made by its passage through the glass, leaving for a measure then a ball of the same character that has *not* been fired. We will see how this supposition is carried out farther on.

The original window produced in court was no criterion. From repeated handling the hole made by the bullet had become enlarged and changed in shape. Mr. Leet in experiments of shooting at glass, obtained one shot in which the full sized unfired .44 ball would not wholly pass. In a series of forty-five rounds, fired with the Billings' carbine, at distances ranging from two to seventy feet (61 cms. to 21¾ meters,) some at varying angles, others point-blank, the object, glass of the same size and thickness as the Billings' window, I obtained one shot where the hole made would not admit a full sized ball. I give the record of the shooting as taken at the time :—

FIRING RECORD.

Ballard carbine, old style, .44 calibre, long cartridge, 220 grains (14.256 gms.) lead, 28 grains (1.814 gms.) powder. Experiments made May 8th and 10th, 1880, in the 10th Reg't Armory, Albany, N. Y. Shots fired through glass set in

sashes; glass 28x13½ inches, (71 by 34 cms.) double thick, American make.

FIRST SERIES.

No. of shot.	Distance.	Direction.	Character of hole.	Size of hole.
1	10 ft. (3 m.)	straight	round	ball passed
2	" "	oblique	irregular	" "
3	8 " (2.438 m.)	"	"	" "
4	" "	"	"	" "
5	" "	"	"	" "
6	10 " (3 m.)	straight	"	" "
7	" "	oblique	"	" "
8	" "	straight	"	" would not [pass
9	" "	"	round	" passed
10	" "	"	"	" "
11	" "	oblique	"	" "
12	8 ft. (2.438m)	oblique	irregular	ball passed
13	10 " (3 m.)	"	"	cartridge passed
14	" "	str'ght	"	" "
15	3 " (0,914m)	"	glass bl'wn out	
16	10 " (3 m.)	"	round	ball barely "
17	20 " (6 m.)	"	irregular	cartridge passed
18	10 " (3 m.)	"	round	ball barely "
19	70 " (21¼ m)	"	irregular	cartridge "
20	" "	"	round	ball "
21	" "	"	"	" "

SECOND SERIES.

No. of Shot.	Distance.	Direction.	Character of hole.	Size of hole.
1	10 ft. (3 m.)	oblique	round	cartridge passed
2	" "	"	irregular.	" "
3	10 ft. (3 m.)	straight	"	" "
4	" "	"	"	" "
5	" "	"	"	" "
6	" "	oblique	"	ball barely "
7	" "	"	"	cartridge "
8	" "	straight	"	ball "
9	" "	"	"	cartridge "
10	" "	oblique	"	ball "
11	" "	"	"	cartridge "
12	" "	straight	"	" "
13	10 ft. (3 m.)	str'ght	irregular	ball passed
14	" "	oblique	"	cartridge passed
15	8 ft. (2,438m)	str'ght	round	" "
16	" "	"	"	ball "
17	10 " (3 m.)	oblique	"	cartridge "
18	" "	"	square	" "
19	" "	str'ght	round	ball "
20	6 " (1.828m)	"	"	cartridge "
21	4 " (1.219m)	"	irregular	" "
22	3 " (0.914m)	"	"	" "
23	" "	"	"	" "
24	2 " (0.609m)	"	glass bl'wn out	

SUMMARY.

Balls unable to pass,	1.
" barely passed,	3.
" "	18.
Cartridge "	21.
Glass blown out,	2.
Total, - -	45.

Six rounds were fired from a Colts' navy revolver, old style, .36 calibre, at distances varying from 10 to 20 feet (3 to 6 meters). The holes made were so large that the barrel and ramrod could be passed without touching.

These experiments were made in the presence of several witnesses, and each shot and its result noted when made. One shot made a hole through which a full sized ball would not pass. I do not consider it such a wonderful or impossible feat that such was the case. A ball, conoidal in form, passing with great velocity, strikes glass. It punches a hole, but does not fracture the glass around the point of entrance. The point struck is instantaneously disintegrated, and so rapid is the shock that it has not time to call upon the surrounding particles for support, hence the smallness of the hole. As glass is made it varies in elasticity. Some parts of the sheet which is to be cut into panes, cool more quickly than others. These become, therefore, more brittle, while the portions longer in cooling retain more elasticity. A bullet then, striking a portion of glass cooled slowly, strikes an object which will yield somewhat to the force. Doing this, the hole made would be smaller than if a more brittle part had received the ball. Further, all rifles taper more or less from breech to muzzle. That is, the muzzle will measure one or more hundredths of an inch (4 mm. or more) less than the breech. The bullet being forced through the narrower aperture, yields to the pressure and becomes smaller. The gun under consideration was measured at the National Armory, Springfield, Mass., and found to be .44 at the breech or chamber, and .423 at the muzzle. Considering these various statements, the one that a ball of known size will make a hole through glass smaller than the size of the ball when fired, is not one admitting doubt as to its verity.

But the weight of the ball was too little. The Billings ball weighed 165 grains, (gms. 10.691) and had it been a ".44 long," it should have weighed more. In firing at human skulls, the subjects in all the trials but the last two, being placed in a sitting posture, and in some a sash like the Billings window in front of the subject, I found the ball to lose lead according to the amount of resistance it met with, and the amount of bone ploughed in its passage. The experiments proved conclusively, if nothing more, that the weight of a ball taken from a body after being fired, it having traversed bone in its flight, is not positive evidence of the weight before firing. An exception might be made to this in a slight degree. As ammunition is now manufactured, bullets run in uniform weights, small-arms being brought to a uniformity of calibre. When the rifle or pistol is one of old style, muzzle loading, and the bullets are made by hand, then great variety of weight is to be expected, but the muzzle-loader has been almost universally succeeded by the breech-loader, and fixed ammunition has taken the place of loose. The weight of the ball, therefore, taken after firing, may lead to the weight of the full ball before firing, only by recognizing the fact that a ball always loses some lead when passing through bone. If the ball given is of the kind used in fixed ammunition, the full sized ball will be of greater weight than the one recovered post mortem. In this case we have but 165 grains (10.691 gms.) of lead. From what has been stated before, the bullet was proved of .44 calibre. We find in fixed ammunition, balls of .44 calibre of different weights, one weighing 205 grains (13.283 gms.) belonging to the army revolver, another of 220 grains (14.256 gms.) and to this latter class it was claimed the bullet killing Mrs. Billings belonged, for that is the weight of the ball in a ".44 long," and the shell found in the carbine told the class. In proof of this I refer to the following table, stating that as in the former experiments the rifle used was the one produced at the trial, and the ammunition the "commercial long .44" :—

FIRING RECORD SHOWING LOSS OF LEAD.

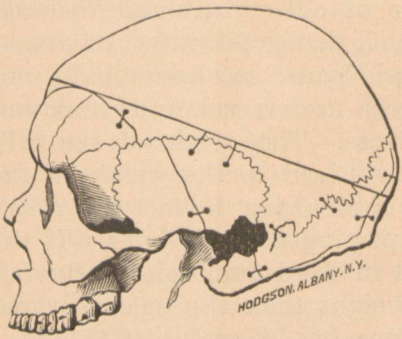
Ballard carbine, old style, 44 calibre, long cartridge, 220 grs. (14.256 gms.) lead, 28 grs. (1.814 gms.) powder. Experi-

ments made in the Dissecting Room of the Medical College, Albany, N. Y.

1st Shot, through glass, distance 13 feet (3.962 meters,) from subject:—

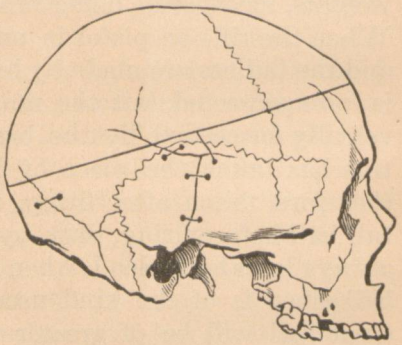
Weight of ball	220 grs.	(14.256 gms.)
" " recovered	178.216 grs.	(11.551 gms.)
" of lead found	15.430 "	(1 gm.)
Total weight of lead recovered	193.646 grs.	(12.551 gms.)
Loss, not found	26.354 "	(1.705 gms.)

Fig. 1.



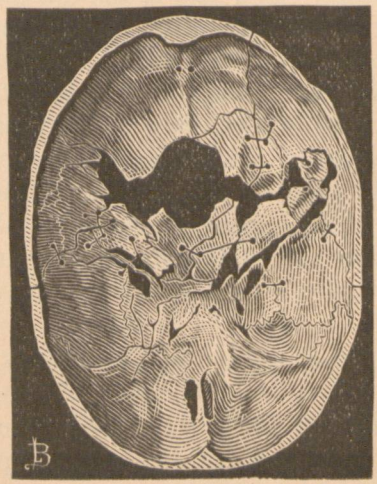
Point of entrance of ball.

Fig. 2.



Place of exit.

Fig. 3.



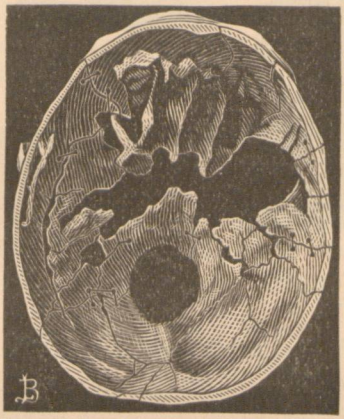
Both petrous portions in position.

2d Shot, through glass, distance from subject 18 feet, (5.486 m.):—

Weight of ball----------220 grs. (14.256 gms.)
" " recovered----------198.320 grs. (12.851 gms.)
" of lead found----------000.000

Total weight of lead received----198.320 grs. (12.851 gms.)
Loss, not found---------- 29.680 " (1.405 gms.)

FIG. 4.



Petrous portions in position.

3d Shot, no glass, distance 25 feet (7.62 m.) from subject:—
Weight of ball----------220 grs. (14.256 gms.)
" " recovered----------208.932 grs. (13.538 gms.)
" of lead found----------000.000

Total weight of lead recovered--208.932 grs. (13.538 gms.)
Loss, not found---------- 11.088 " (0.718 gms.)

FIG. 5.

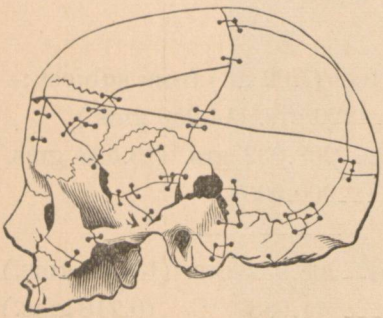
Left petrous portion present.

(Owing to extreme fracture of base, the right petrous could not be wired in its place.)

4th Shot, no glass, distance 35 feet (10.668 m.) from subject:—

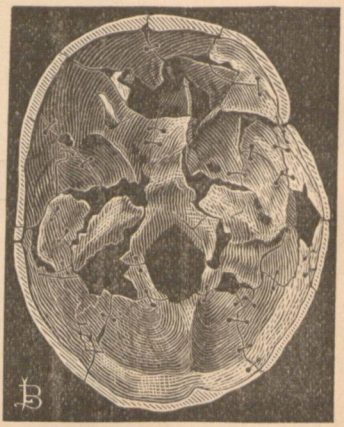
Weight of ball	220 grs.	(14.256 gms.)
" " recovered	215.875 grs.	(13.988 gms.)
" of lead found	.154 "	(0.010 gms.)
Total weight of lead recovered	216.027 grs.	(13.998 gms.)
Loss, not found	3.975 "	(0.258 gms.)

FIG. 6.



Point of entrance.

FIG. 7.



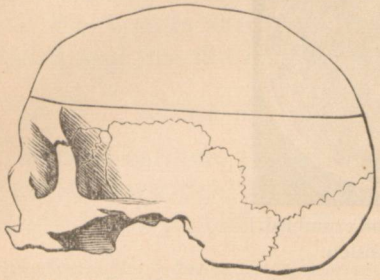
Both petrous portions in position.

5th Shot, no glass, distance 10 feet, (3 m.) from subject:—

Weight of ball----------220 grs. (14.256 gms.)
" " recovered----------169.443 grs. (10.979 gms.)
" of lead found----------000.000

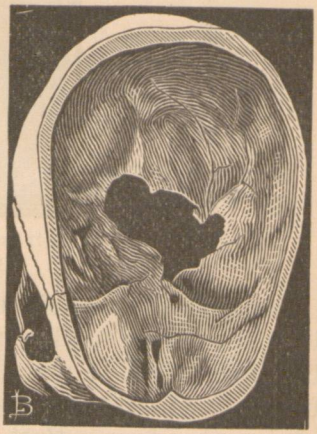
Total weight of lead recovered--169.443 grs. (10.979 gms.)
Loss, not found---------- 50.557 " (3.277 gms.)

FIG. 8.



Point of entrance just in front of mastoid process.

FIG. 9.



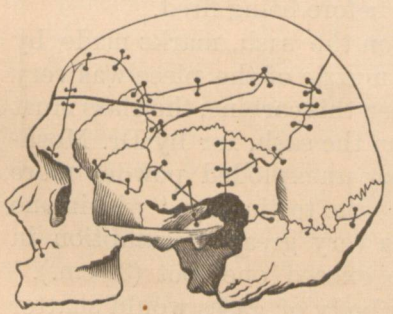
Left petrous portion crumbled. Right in position. The ball passed under the base on the right side.

6th Shot, no glass, distance 10 feet (3 m.) from subject:—

Weight of ball----------220 grs. (14.256 gms.)
" " recovered----------159.291 grs. (10.321 gms.)
" of lead found----------000.000

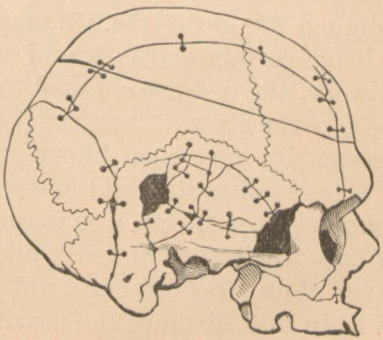
Total weight of lead recovered---159.291 grs. (10.321 gms.)
Loss, not found---------- 60.709 " (3.935 gms.)

FIG. 10.



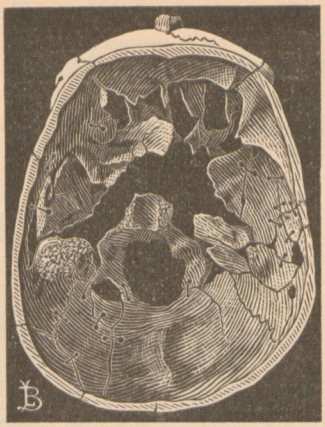
Point of entrance.

FIG. 11



Point of exit.

Fig. 12.



Left petrous portion crumbled.
Right in position.

Looking at these six experiments we find varying losses of lead, all bullets used being the same general weight. In the last two trials, it will be noticed, the distance was but ten feet (3 m.) from the muzzle, yet more lead was lost than in any of the other four. Part of this may be explained by what we shall see hereafter concerning the course of the ball, and part by the fact that both balls were fired at "close quarters." The least loss recorded took place at the longest distance, thirty-five feet (10.668 m.). As I have said, this, in part, accounts for the loss of lead, for at ten feet (3 m.) the bullet has not acquired its greatest amount of penetrating power. By actual experiment, then, it is seen that a 220 grain (14.256 gm.) ball, fired at the human skull, will lose more lead than was found gone in the Billings bullet, thus disposing of the question raised by the defense that the ball could not have weighed 220 grains (14.256 gms.) before being fired.

From certain marks found upon the sash, marks made by powder, the defense claimed the muzzle of the piece was very close to the glass. That had it been this carbine, the glass must necessarily have been blown from the sash, for by Dr. Mosher's testimony, it would not carry unexploded powder more than two feet (61 cm.), or to quote the testimony, "within one or two feet (30 to 61 cm.), and a very great presumption in favor of one foot (30 cm.), not to exceed one foot (30 cm.)." Within that distance the moving body of gases would shatter

the pane. If we examine into this point a little more closely, its seemingly strong bearing in favor of another weapon than the Billings carbine will lose some, if not all of its force. In order to test the matter I made a series of experiments. Seven boards, placed at distances from two to ten feet (61 cm. to 3 m.) from the muzzle, were successively fired at. The following is the record taken at the time, and I would say every shot fired was in the presence of witnesses, every shell marked, and the boards after the experiments sealed in a package, which seal was not broken until they were produced in court.

EXPERIMENTS TESTING POWDER MARKS.

Ballard carbine, old style (Billings), .44 calibre, commercial long .44 cartridge. Experiments made May 6th, 1880, 10th Reg't Armory, Albany, N. Y.:

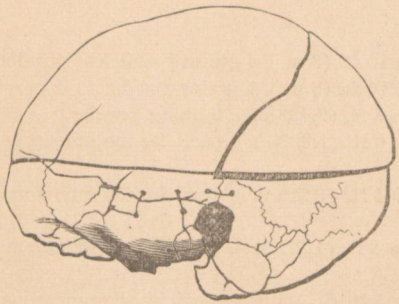
Experiment No. 1, board No. 1, distance 10 ft. (3 m.), 6 grains [particles] powder.
Experiment No. 2, board No. 2, distance 10 ft. (3 m.), 5 grains powder.
Experiment No. 3, board No. 1, distance 8 ft. (2.438 m.), 9 grains powder.
Experiment No. 4, board No. 4, distance 6 ft. (1.828 m.), particles too numerous to count, also lubricant.
Experiment No. 5, board No. 5, distance 4 ft. (1.219 m.), particles too numerous to count, also lubricant.
Experiment No. 6, board No. 6, distance 4 ft. (1.219 m.), particles too numerous to count, also lubricant.
Experiment No. 7, board No. 7, distance 2 ft. (0.609 m.), particles too numerous to count, also lubricant.

Producing these boards in court, they were submitted to Dr. Mosher, and he found "what looked like" powder in all. Taking the boards, each in turn, some of the grains were picked from the wood and placed on glass. A platinum wire point, heated by Dawson's galvano-cautery battery, being brought in contact with the grains, demonstrated whether the particles would explode or not. At ten feet no flash could be elicited. At eight feet and from that down, distinct flashes were seen. The carbine, therefore, could carry unexploded powder far enough to remove the danger of the glass being shattered by the gases following the discharge. This latter result I found in my experiments to take place at from two to three feet (60 to 90 cms.)

Another point claimed by the defense was, that this ball, taken from Mrs. Billings' head, had been fired from a weapon of low velocity, and that accounted for the fact that the ball

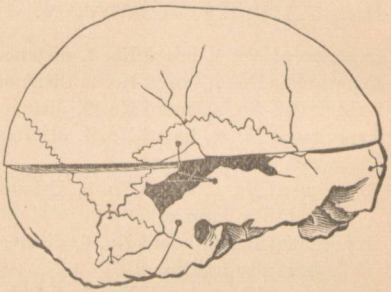
failed to pass out of the skull. Lieutenant Morrison,* U. S. Ordnance, who tested the carbine with government velocimeters at the Springfield Arsenal, testified the mean velocity obtained to be 998.8 feet (327.625 m.) per second. Had the velocity been as high as was thought by the defense, from 1,300 to 1,400 feet (426 to 459 m.) per second, ordinary rifle velocity, the argument that a ball from such a weapon would always go through the skull, would have been more difficult to combat. But with the velocity found by actual tests, the energy of the ball was lessened almost one-half. The correct energy was found to be 521.1 foot pounds, a very different affair than if it were about one thousand.

FIG. 13.



Mrs. Billings' skull. Point of entrance of ball

FIG. 14.



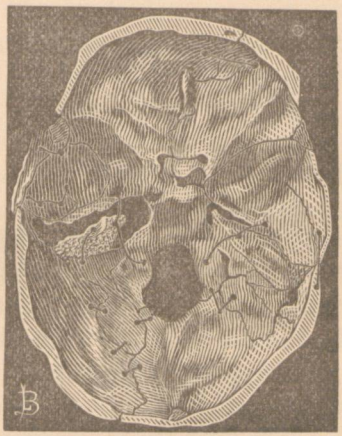
Mrs. Billings' skull. Hole made by piece of bone being driven outwards backwards.

The bullet which killed Mrs. Billings did not pass entirely through the skull. It entered as already stated on the left side. On the right side a wound was found over the mastoid portion about two inches (51 mm.) in length, undoubtedly made by a piece of bone cutting its way outwards. At the bottom of this wound, lodged in the upper surface of the petrous portion where it joins the squamous, lay the bullet. It ploughed into the petrous portion at this point, and broke before it a triangular piece of bone, part of the temporal opposite where the ball was imbedded. This piece, as testified to by Dr. Grant, was pushed outwards, cutting through the tissues and making the wound above noticed. This is an impor-

*I would record my thanks to Captains Staring and Greer, and Lieutenant Morrison, of the Ordnance Corps, for their courtesy and kindness in offering me every facility for making what tests I wished of the Billings carbine.

tant fact. We have here strong resistance to the ball, for this piece of bone, in cutting its way out, cut through the fascia of the temporal muscle, the superficial fascia, and the skin, the latter a force of such elastic character, that it often stops a ball which has traversed much less bone than I shall show this to have done. Besides this factor in the non-passage of the ball through the skull, we have its evident downward course at the point it was found, which, for it led it into the right petrous portion, caused more resistance than its already impaired energy could overcome.

FIG. 15.



Mrs. Billings' skull, inside view, showing left petrous portion gone, and on the right side, the place where the ball lodged. The portion of what seems to be the petrous on the left side, is in part mastoid and part petrous, the inner point belonging to the latter, and holding the styloid and vaginal processes underneath.

I think if we look over what has just been said, we shall find the Billings' carbine could not only have been the weapon used, but that all the evidence points to it *as* the weapon. We have:—the gun found in the old well; the search for this gun; it having been about Billings' store up to or near the time of the murder, but not found after the murder till drawn from its hiding; three witnesses swearing to its identity; Billings' anxiety about it as shown by the evidence concerning his conversation with his clerk; the ball being by three experts declared to be of .44 calibre; Dr. Mosher making it so by measuring the "lands and grooves," of which he assumed five, the number in the carbine; other bullets of the same claimed calibre and weight, under nearly similar circumstances,

losing as much or more lead; the weight of the ball putting out of consideration any of *less* weight, and from the known fact that leaden bullets lose some of their substance when passing through bone, it must have weighed more than 165 grains (10,692 gms.) before firing; that the marks on the ball showing the rotary motion given by the rifling, showed that rifling to be the left handed twist, the twist of the Ballard carbine; that it could carry unconsumed powder over two feet (60 cms.); that it was a weapon of low velocity; that in consequence its penetrating force was one-half that estimated by the defense; and, finally, that two witnesses obtained in experimenting a hole through glass which would not admit a full sized ball of the kind fired. I think the fallacy of the answer to the following question fully proven:—

(Question to Dr. Mosher:) "Is it possible upon any principles of physics or science that the bullet which was taken from Mrs. Billings' head, could have been fired from that carbine?"

A. "It is utterly impossible."

We come now to study the effects of the ball upon the bone, and look somewhat into the evidence as regards the amount of resistance met with by the Billings' bullet, as compared with those fired in the various experiments. The ball entering Mrs. Billings' head about half an inch (13 mm.) above the left meatus-auditorius externus, (Fig. 13,) passed through the major part of the petrous portion of that side, crossed over behind the dorsum ephipii in a somewhat curved line, and lodged at the junction of the right petrous and squamous portions, on the anterior surface of the petrous, (Fig. 13.) Here it ploughed for itself a resting place, and from here Dr. Grant removed it at the autopsy. For the first effect of the shot, we notice the skull was riven apart from before backwards, and from side to side. One main line of fracture leads from the wound of entrance to the foramen-lacerum-medium, through the body of the sphenoid to the right middle lacerated foramen, following on in the line of the glenoid fissure, thus separating the skull into two parts, anterior and posterior. Another main line ran forward from the body of the sphenoid a little to the left of the median line, crossing over to the right just behind the crista galli, ending over and through the right supra-orbital notch. This fracture posteriorly led from the left posterior lacerated foramen along the groove for the occipital

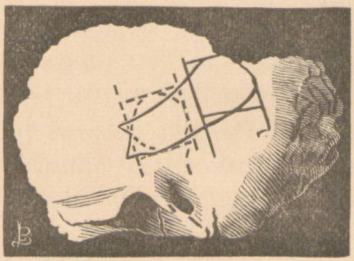
sinus, upward to the left of the median line nearly to the lambdoidal suture. Several other smaller fractures radiated in different directions. The calvarium was not completely divided in two. Very nearly however, for a line of fracture ran from the upper edge of the bullet-hole upwards and backwards to the left parietal eminence, and from there to the corresponding boss on the right side. Here it was nearly joined by a fracture coming from the place where the ball lodged. The petrous portion of the left side was all gone except a small piece having the styloid process attached. The petrous portion of the right side was intact excepting the fracture already spoken of and the space ploughed out by the lodgment of the ball. By studying these lines of fracture we see the force was in such a manner that it tended to spread the base. This is the more apparent when we look at the point of impact. It is two-thirds the size of the ball, that is two-thirds its diameter on the base of the left petrous portion. As we all know, the petrous is an excessively hard bone traversed by various aqueducts and canals, but almost entirely devoid of cancellous tissue. Its position in the skull is that of a buttress, if I may use such a word. Any force then, such as a bullet striking it on its base, ~~just~~ tends to drive this wedge-shaped piece into the skull, separating the surrounding bones. It communicates the shock of the impact *before* it gives way to the force, and is itself crumbled. From this fact, in conjunction with its excessive hardness, it must necessarily offer the greatest amount of resistance to the passage of a ball, and so destroy to a great measure the penetrating force of the missile. When, however, it *does* break by reason of this very hardness, it breaks completely; breaks, if struck squarely, into such fine pieces as to preclude all possibility of restoration by art. This fact, and I claim it is a fact, I think will be fully proved when we come to study the specimens prepared from my experiments of firing at human skulls. If the ball had struck any other portion of the skull, numerous and various fractures would still be found, not mayhap in exactly the same lines, and the petrous portion if *not* struck would be broken into fragments that could easily be recognized. *The petrous portion would not be crumbled.*

When the force is applied then to the base of the petrous portion, it is transmitted across to the basilar process, the

foramen lacerum medium being partially filled by fibro-cartilage. This serves as a buffer, and should the force not be great, small harm to the skull may be the result. Should, however, the force be such as is given by a bullet, then the shock is so sudden, so rapidly and strongly transmitted that a solution of continuity results. A ball could strike no portion of the head where greater resistance would be met, and the character of the fragments resulting from a fine comminution of the petrous portion is such as to cause great loss of lead.

By looking at

Fig. 16.



we find the entrance of the Billings' bullet marked by the dotted lines. The markings were made by Dr. Mosher and myself, while the doctor was on the stand, on a separate temporal bone. The continuous line marks the bullet hole in the skull presented by Dr. Mosher, to which reference will be made further on. I would say in explanation of the cut, that the photographer placed the bone in such a position that part of the under surface was exposed to the camera, thus making the ball holes appear higher than proper. Taking this entrance point, careful measurements were made to see how much of the petrous portion the ball had to pass through, and it was found and so stated from the witness stand, that the bullet traversed all that bone lying between its entrance and the meatus auditorius internus. On the right side (Fig. 13,) we see the place ploughed in the anterior surface of the petrous portion where the ball lay. This course was carefully measured and we found the ball had passed through about two inches (51 mm.) of bone, and from what we have just found from the character and position of the bone, met with

great resistance. In addition to these elements deadening the way of the ball, we must take into consideration the character of the skull, that is its thickness and denseness of bony structure. The measurements give:—

Over right ear-----	0.08	(inches,)	(2 mm.)
" left " -----	0.09	"	($2\frac{1}{4}$ mm.)
Frontal right------	0.28—0.28	"	(7.1 mm.)
" left---- ---	0.27—0.28	"	(6.8 m. to 7.1 mm.)
Occipital right----	0.23	"	(5.8 mm.)
" left-----	0.29	"	(7.36 mm.)

These measurements show the skull more than of ordinary thickness, increasing, therefore, the resistance to the ball, it being a natural sequence that any article of a given material and a given form a quarter of an inch (6 mm.) thick, would require greater force to break than if only one-eighth of an inch (3 mm.). Not only was the skull of Mrs. Billings thicker than normal, but it was of very dense structure. By that I would mean more of the hard bony tissue than cancellous, for the diploë was almost entirely wanting. The skull was nearly ivory. The claim of the defense that a ball from this carbine would always pass through the head is one difficult of proof. When we take into consideration the low velocity, the consequently moderate amount of penetrative force, the resistance offered by the thickness and denseness of the skull, by the amount of bone ploughed, by the piece of bone pushed outwards on the right side through the slow yielding tissues and skin, the weight attached to the following testimony is but little.

(Question to Dr. Mosher:) "Is it possible for any condition to exist that would prevent the passage of a bullet fired from such a carbine as the Billings carbine from passing clear through the head?"

A. "No, sir."

In further presenting this part of the subject, I would call attention to the experiments before quoted. The engravings show fairly the tracks of the bullets. In all the ball passed through the entire skull. When the shot was fired at the longest range, thirty-five feet, (10.668 m.) it not only penetrated the skull, but penetrating the parietes continued its course through a hair cushion about four inches (10 cm.) thick, and was

stopped by the wall, making an indentation in the plaster (Exp. No. 4, Figs. 6 and 7). The ball did not touch the petrous portion on either side, still both were broken. When the shot was fired at ten feet (3 m.) from the head (Exp. No. 6, Figs. 10, 11, 12), the subject, one so far decomposed that no resistance could be given by the skin, muscles or brain, the ball had but force enough to pass through the skull and roll from the table to the floor, and this in a skull much thinner than that of Mrs. Billings. Why this marked difference? In the one case the ball had attained its full velocity, and encountered but small resistance, passing as it did through the parietes. In the other it was at short range, and *ploughed the left petrous portion.*

The defense produced a skull upon which a like experiment had been tried, the Billings carbine being the weapon used. I ~~wrote~~ the description of this experiment from the testimony as given by Dr. Mosher, "with a gun which was furnished and understood to be the Billings gun, called by that name, a Ballard cartridge was fired through glass into a head, and the scalp and all the integuments as they were in life, attached to the trunk, and containing the brain, care being taken to throw the ball as near as possible in the same place, on the left side, as is marked on the Billings skull."

Q. "At what range was it fired?"

A. "At five feet (1.524 m.) from the glass, which was two feet from the skull."

Q. "What was the position of the subject?"

A. "The subject was placed in a semi-erect position, simulating as near as possible as to the position of the head, the position of a person sitting."

Q. "Proceed."

A. "After firing the ball was preserved, and an examination made of the skull to see the kind of injury that the ball had made in passing through it. It had passed through both sides of the skull and gone out of it, as a 44 calibre ball with an ordinary charge *always will.* The lower jaw was upset, thrown out of its place. My hand placed on the scalp found all the bones of the skull rattling. A most extraordinary and extensive series of fractures were apparent. On dissecting them apart the skull was found broken up in many pieces, so many that it was a matter of some work to get them together

again to show the form of the skull after it was cleaned. In the track of the ball, which had struck the petrous portion, *which had struck fairly and comminuted it*, the ball had passed into the *petrous portion of the right side*, and gone out on the right side, leaving a hole four inches in diameter. There was a hole I could put my fist through when the scalp was removed."

Q. "How did it pass out on the right side?"

A. "*Just above* the petrous portion on that side."

Q. "Did you find the ball?"

A. "I found the ball, it had passed through and *lodged* in a piece of board which it had split."

Q. "Where did you find the ball?"

A. "It had *dropped* just in *front* of the board on the table."

The table was an ordinary dissecting table. It will be noticed that the ball passed through the head, but although it split the board, it had not sufficient energy left to enter the wood, but fell on the table, only a short distance beyond its exit from the skull. After describing the lines of the various fractures, Dr. Mosher gives the location of the ball at its entrance.

"The ball entered at a point just above the ear, and taking up about one-half the size of the ear as it entered. That will give an idea of its location. It passed through and struck *square the petrous portion* of the bone, and it is *gone*, or so broken up that it cannot be replaced. It passed over the petrous portion of the right side, which would indicate by its being present the amount of damage that was done to this side" (the left).

The ball which was used in this experiment, was sworn to as being before firing of 220 grains (14.256 gms.) weight. After having "struck square the petrous portion," and passed through the parietes, it weighed 207.06 grains (13.417 gms.) We will refer to this later.

Upon cross-examination, measurement of the bullet holes as seen in the skull presented by Dr. Mosher, and in that of Mrs. Billings were made. (Fig. 16.) These measurements brought out the fact that the ball in the Billings' skull entered its *full size lower and nearer* the meatus auditorius than the other. Or, in other words, the Billings ball struck more

squarely the petrous portion ; Dr. Mosher's bullet going mainly through the mastoid portion, merely touching the petrous as its upper edge turns to join the squamous. By measurement the amount of bone traversed by the two bullets, was found to be over two inches (51 mm.) in the Billings skull, and less than *one-half of an inch* (13 mm.) in the other. To follow the testimony further on, we find that in the débris saved by Dr. Mosher when cleaning the skull he presented, a large piece of the left petrous portion was found. It was handed to me when on the stand, and described as follows:—

Q. "Does the amount or condition of the débris in those two cases (Billings and Mosher,) indicate anything as to the extent of resistance which the ball encountered ?"

A. "I think it does in this manner. I have in my hand a large portion of the left petrous portion."

Q. "How large ?"

A. "The end of it, very nearly all of it ; there is but very little more coming in there. (Indicating the base.) I tell it to be the left petrous portion by the fact that holding it in this position, (the normal one,) I find a hole which is the internal opening of the ear, pointing outwards and backwards, and then looking on the top of it, I find there a part which would tell me the position of the internal ear, (eminence over semi-circular canals,) and looking on the point of it *here*, I find where the carotid artery comes out, and turning it over, I find the canal where the carotid artery goes in. Then holding the bone in that manner, in the position in which it is in the skull, you see the carotid artery goes through *there*, takes that turn. I find one or two other marks about the bone, mere anatomical marks which show to me that this is the major part of the petrous portion of that temporal bone."

Clearly then the ball in Dr. Mosher's experiment did *not* strike the petrous portion of the left side *fairly and squarely*. Had the bullet so done, so much could not have remained as to allow the description given above. The resistance offered the two bullets *could not* have been the same. One does not need to study far nor deep to say, that a ball of given weight and velocity, passing through two inches (51 mm.) of bone, meets with more resistance than if it passed through only half an inch, (13 mm.) even supposing the bone to have been of like character in every way.

Referring once more to my experiments, the only two bullets that ploughed the petrous portion, were those of the last two shots. In trial No. 5, the ball passed under the skull on the right side, after having crushed the left petrous. In trial No. 6, the ball followed more nearly the course of the Billings bullet, and had it struck on the right side, as the ball killing Mrs. Billings did, like it, it would have remained in the skull. In all the other experiments, however broken the skulls might be, the temporal bones could be found in the wreck, and in such pieces as to be easily vouched for. The experiments prove, I think, the soundness of the statement, that when a ball of sufficient weight and energy strikes the petrous portion of the temporal bone, that portion *crumbles*, but when the same ball with like power strikes other parts of the skull, the petrous portion is broken by the force of concussion, but *does not crumble.*

Whether a ball fired from the kind of weapon before referred to will always pass entirely through the head, I will leave for my hearers to decide. Many have had large experience in such matters, where bullets of greater calibre, driven by weapons of far superior power, have failed to pass out of the head. Our text-books and records show many such cases. Notwithstanding the fact that none of the shots I fired staid in the skull, the experiments have satisfied me, that at the range of ten or twelve feet, (3 to 3.6 m.) a ball from what is known as a ".44 commercial long" cartridge, fired from such a weapon as the Billings carbine, would, and it *ploughed the petrous portion*, stay in the skull as often as it would have energy left to leave it.

CONCLUSIONS.

The conclusions I reach from the foregoing statements are as follows :—

1st. A leaden bullet passing through bone, loses lead in proportion to the amount of bone traversed.

2d. If the petrous portion of the temporal bone be the part struck by the ball, and struck squarely upon its base, that portion of bone is crumbled or broken in such exceedingly fine pieces as to defy restoration.

3d. That if the ball strike any other part of the skull, the petrous portion may be broken, but can be easily recognized and generally put again together.

4th. That a ball of given calibre, fired through glass, may make a hole enough smaller than the full size of the ball before firing, to prevent an unfired ball of like calibre passing.

NOTE.—In further reference to this part of the subject, I would state I have to-day seen a base ball, thrown with great force and having a rotary twist, make a round hole through an ordinary window light, and when the ball was tried to be again passed through the same opening, the hole was nearly one-third too small. Dr. S. O. Vander Poel, Jr., of Albany, tried to pass the ball two or three times, convincing all who saw it that it had made a hole smaller than itself when passing through glass, the elasticity of the pane allowing it to yield.

ALBANY, N. Y., Aug. 18, 1881. LEWIS BALCH.