insisted upon by the Government in an attempt to limit the incidence of puerperal sepsis.

It is obvious from the writings and speeches of public health officials, as also from those of the laity, either personally or combined in the form of the approved societies, that a great movement is taking place to insist that the present deplorable maternal and infantile mortality and morbidity ought to be, and shall be, diminished. If, therefore, the medical profession itself does not take up the question seriously and now, it will wake up one morning to find that all kinds of rules and regulations have been made that may seriously affect its position. Let us all do our best; it is no use cursing each other; this will not improve matters; this will not save a single life. The general practitioner, apart from the patient, is the most seriously concerned. By insisting on ante-natal supervision, by linking up with the county health authorities, by welcoming the assistance of obstetric experts, bacteriologists, trained nurses, and voluntary societies, by reporting at once cases of fever during the puerperium, by giving willingly all the information he can to those constituted to receive it, the general practitioner is bound to be the chief instrument in the reduction of the maternal and infantile mortality and morbidity.

THE IDENTIFICATION OF FIREARMS AND PROJECTILES

AS ILLUSTRATED BY THE CASE OF THE MURDER OF
SIR LEE STACK PASHA.

BY

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(With Special Plate.)

On November 19th, 1924, Sir Lee Stack Pasha, the Governor-General of the Sudan and Sirdar of the Egyptian Army, was shot while returning from the War Office in Cairo about 1.30 p.m., and died on the following day. His aide-de-camp, his chauffeur, and a native policeman were wounded, but recovered.

This was the culminating point of a series of political crimes which, commencing with the attempted murder of Captain Combe in November, 1919, accounted for thirty attempts at murder, of which twelve were successful. Of these, seven took place in November-December, 1919, seven in 1920, two in 1921, and thirteen in 1922. If we exclude the attempt on Mr. Amber in February, 1923, and the stabbing affair at Heliopolis in the same year, the political significance of which is doubtful, no further cases of political murder occurred until the Sirdar case in November, 1924.

The action taken by the British Government and the political effect of this outrage are foreign to the purpose of this article, and I shall confine myself to the study of the crime from its medico-legal aspect, to the exclusion of all other considerations.

The Sirdar died on November 20th, and a necropsy was performed the next day, when the following injuries were found:

1. A wound of the left hand from a bullet which entered on the internal aspect at the base of the little finger and made its exit on the back of the hand at the base of the fourth metacarpal bone.
2. A wound of the left foot from a bullet which entered in the middle of the sole and passed to the outer side of the foot below the ankle, from which position it was extracted before death.
3. A wound caused by the entrance of a bullet on the outer side of the right pelvic bone just below its crest. The bullet passed upwards and inwards through the muscles of the abdominal wall to the level of the right lower ribs. It was slightly deflected to the left at this point, entered the abdominal cavity, and passed through the gall bladder and liver. It made its exit on the left upper diaphragmatic surface of this organ, causing a ruptured wound $1\frac{1}{2}$ inches long. It continued its course through the diaphragm, entered the chest at the level of the xiphisternum, and was found in the tissues of the anterior mediastinum under cover of the fifth left costal cartilage and immediately above the heart. There was no damage to the stomach or intestines or any haemorrhage within the peritoneal cavity.

The bullet extracted from the body was a 0.32 automatic bullet, the tip of which had been cut in a cross-shaped manner with the object of converting it into a "dum-dum" or expanding bullet. Death was due to shock and haemorrhage, the direct result of the bullet wound of the abdomen.

The aide-de-camp, Captain Campbell, received a bullet wound in the right side of the chest, probably from the same bullet which struck the Sirdar's hand. The chauffeur, March, received a bullet wound of the right leg just above the knee, and a native policeman received a bullet wound of the right hip region. An examination of the car showed that it had been struck five times on the right side, the direction of fire being from before backwards.

The reconstruction of the crime from the above information is not difficult. The assailants were waiting on the right side of the road and began to fire just before the car reached them; the first shot probably passed through the forward door of the car and entered the chauffeur's leg, passing upwards towards the thigh. The next shot probably struck the Sirdar's hand, smashed the stick that he was holding, and was deflected into Campbell's chest. The latter then in all probability pulled the Sirdar down into the body of the car, and as he did so the Sirdar's foot was raised as he overbalanced and a bullet was received in the sole. Finally, while in this position another shot was fired at him, striking him in the right hip and passing across his abdomen to the left side of the chest.

MATERIAL OBTAINED FOR INVESTIGATION.

Nine empty cartridge cases were found at the scene of the crime. These were all 0.32 inch automatic pistol ammunition, and from an examination of the extractor and other marks it was shown that three different types of automatic pistols had been used.

Six bullets were obtained from various victims; all of these were 0.32 inch automatic pistol ammunition with a heavy cupro-nickel jacket. Five of them had a cross-shaped incision in the tip to convert them into expanding bullets.

An examination of the projectiles showed that at least three different types of weapon had been used—namely, (1) a weapon of the Colt type with six left-handed rifling grooves, (2) a weapon of the Browning type with six right-handed grooves, and (3) a weapon of the Mauser type with four right-handed grooves.

Wholesale arrests followed the crime, and though certain of the actual murderers were arrested not a shred of evidence was obtained, in spite of all the efforts of the investigating authority. Fortunately a native named Helbawi, who had served a term of penal servitude for a previous attempt on the life of Sultan Hussein, was liberated from prison about this time, and decided to turn secret agent. With his history he had no difficulty in getting into contact with the suspects, and soon learned that two of the gang were young students named Enayat. From his knowledge of the psychology of the native he advised that the best plan to follow was to frighten these young men into flight, and to suggest that they should make for Tripoli. The object in suggesting Tripoli was to have them arrested in territory under the Frontier Districts administration, where they could be held without the formalities required in the other parts of Egypt. He believed that in these circumstances the younger Enayat could be induced to confess and thus implicate other members of the gang.

Helbawi was successful in his efforts, and managed to scare the Enayats into flight. They were arrested on the train while making for the frontier, and with them were secured four automatic pistols and a quantity of ammunition; these were forwarded to my department for examination in order to ascertain if any of them had been used in the crime.

Examination of Material.

The weapons were of the following brands and calibre:

- 1 Colt automatic pistol 0.32 inch.
- 1 Sûreté automatic pistol 0.32 inch.
- 1 Mauser automatic pistol 0.25 inch.
- 1 Libia automatic pistol 0.25 inch.

The barrels of the weapons were first examined chemically and found to be free from the decomposition products of

FIG. 2.—A, Cartridge case found at the scene of the crime (same as in Fig. 1). B, Cartridge case fired from the Sûreté pistol. Note the eccentric position of the depression in the cap in both cases (1, 2), the position and nature of the extraction mark (2, 3), and the circular depression in cap caused by breech block (3, 3).

FIG. 3.—A, Cartridge case found at the scene of the crime. B, Cartridge case fired from the Colt pistol. The characters of the extraction marks (indicated by arrowheads) are identical.

FIG. 1.—A, Cartridge case found at the scene of the crime. B, Cartridge case fired from the Sûreté pistol. The scratches (1, 2, 3, 4) on the surface of the two cartridge cases are identical.

FIG. 4.—The bullet taken from the foot of the Sirdar.

FIG. 5.—Cast of rifling marks from the foot of the Sirdar (above) and from a bullet fired from the Sûreté pistol (below).

Colt bullet.
Sirdar bullet.
FIGS. 6 AND 7.—Comparison of a bullet fired from the Colt pistol with the bullet which caused the death of the Sirdar. Arrowheads point to scratched grooves caused by a fault in the barrel of the pistol. The ordinary rifling grooves cannot be seen.

A **B**
FIG. 8.—A, Bullet seized in the case.
B, Bullet from the victim. (Side view.)
The manner in which the nickel jacket has been incised is the same in both bullets.

FIG. 9.—Lower part of door taken from the house of Mahmoud Rachid. The lower panel has been removed and the four seized pistols placed in the secret cavity. Note the worn appearance of the nail holes, showing that the panel has been frequently removed and replaced. The sights of two of these pistols caused depressions in the wood as described in the text.

powder. All four were clean, well oiled, and well cared for, but the Sûreté pistol had a trace of rust at the muzzle which might be expected to obscure the identification marks on bullets fired through it. The empty cartridge cases found at the scene of the crime and the bullets extracted from the various victims had now to be compared with cases and bullets fired from the seized pistols.

NATURE OF THE INVESTIGATION.

Before proceeding to the actual comparison it may be as well to indicate briefly the nature of the investigation.

When an automatic pistol is fired the empty case is automatically thrown out of the chamber and a new cartridge slides forward into its place. In this automatic charging and ejection of the cartridge several things happen which leave their imprint on the cartridge case. The cartridge is forced up the magazine, its nose is directed towards the chamber by means of metallic guides, the breech-block strikes the base and forces it into the firing chamber. The firing-pin strikes the cap, and on the explosion taking place the breech-block moves backwards by gas pressure, the extractor hook catches the rim of the cartridge case, and it is pulled backwards with the sliding mechanism until it reaches a bar of metal jutting from the side of the slide. The cartridge case strikes this bar on the side opposite to the extractor hook, and as the hook continues its backward pull the case is thrown out. This occurs with a considerable amount of violence, and we may expect to find certain marks on the cartridge case from each operation, the extent of the marks depending on the violence of the operation. The empty case is therefore examined in detail under a low-power microscope or with a watchmaker's eyeglass for any marks which may have resulted from these operations. On the surface there may be cuts or scratches caused by irregularities in the breech or in the slide: these may be absolutely characteristic and imprinted on every cartridge, and when found may prove that the cartridge case was used in a certain weapon.

The mark of the extractor hook on the edge of the cartridge must be looked for. This varies considerably in cases fired consecutively from the same weapon, in depth, length, etc., but if a number of cartridges are fired the characteristic marks will become obvious. The surface of the base must be examined for the mark of the ejector bar, which often leaves a most characteristic depression. Finally, the position of the depression in the cap, whether central or to one side, and the character and depth of the depression, must be noted.

When a weapon is seized it has to be decided whether the empty cases were fired from that particular weapon. After the preliminary examination already described a number of rounds are fired from the pistol, using several different brands of ammunition, including, if possible, several cartridges of the same make as the ones found. The weapon is fired into a roll of cotton-wool or rags (backed by a sandbag), the object being to obtain the bullets for comparison without distorting them, as well as the cartridge cases. The empty cases are collected and examined in detail as outlined above to observe whether any particular mark found on the seized case is reproduced on the fired cases.

The cartridges may be marked in such a characteristic manner that there can be no doubt of their identical origin, as in Figs. 1 and 2, in which there are scratches on the case of a particular kind, a definite extractor mark on the rim, and a firing-pin which strikes to one side. In other cases the marks may be absolutely different, and at once prove non-identity. A great many cases occur, however, in which the marks are ill defined and the matter becomes more difficult. In numbers of instances the marks from cases fired consecutively through the same pistol have no resemblance whatever, simply because they are ill defined; they are, however, in the same position on the cartridge, and this must always lead the observer to make further experiments and obtain new samples.

It is never safe to say that a cartridge case was not fired from a given pistol unless the marks are quite different, and a case which bears no marks at all may quite well have been fired from the same pistol as one which leaves well defined marks. In general, however, though it is unlikely that all marks will be equally good, it is usually possible to obtain definite information from the marks of the firing-pin, extractor,

ejector, or breech-block on the base or rim, or from grooves or scratches on the surface. In weapons of the same manufacture the marks are of the same general nature, but in every weapon there are individual differences which enable it to be definitely identified in the usual case.

The cartridge cases having been examined, it is necessary to make a close comparison of bullets fired from the seized weapon with those found in connexion with the crime. It is as well to fire half a dozen rounds from the weapon before it is cleaned. It is then cleaned and a further series of rounds fired, using if possible similar makes of cartridges and others of different make. The bullets are then collected, labelled, and examined in detail. The weight, length, and diameter are ascertained. The projectile is then fixed in some sort of an instrument which enables one to examine its surface under a low power, and at the same time to turn it round.

On every bullet fired from a pistol or revolver there will be found certain marks. The most prominent of these consist of a series of grooves, sloping either to right or left, which are caused by the lands in the barrel of the weapon. The number and direction of these grooves are first noted, the pitch is then ascertained, and the width of each groove and space between the grooves. In between the grooves and at different parts of the surface of a fired bullet there are found marks and scratches of various kinds. Some of these are caused by slight faults or patches of rust in the barrel, others are caused by metallic fouling. The former are constant, the latter vary from shot to shot. Each individual groove and space between grooves is now minutely examined under the microscope for some individuality. It is obvious that in weapons of the same manufacture the number, direction, width, depth, and pitch of the grooves will be the same, but in every weapon certain individual differences are usually to be found in one or more grooves. There may also be definite characteristic marks between the grooves.

It should also be clearly understood that a slight difference in calibre of the bullet and a difference in the charge of powder may make a considerable difference in the markings. If the diameter is slightly altered the smaller bullet passes through the barrel without definite grooves being cut into the surface, and even when bullets on measurement appear to be of the same diameter one will frequently be better marked than another.

RESULTS OF THE INVESTIGATION.

Having now outlined the method of procedure, let us compare the cartridge cases and bullets found in the Sirdar case with cases and bullets fired from the pistols seized with the Enayats accused of the crime.

As no 0.25 inch bullets or cases were found at the scene of the crime, attention may be confined to the Colt and Sûreté pistols, for they are of the same calibre as the ones used in the crime.

Empty Cartridge Cases.

(A) Three of the empty cartridge cases discovered at the scene of the crime were found to be marked by a series of scratches on the surface, the ejector bar had caused a deep nick in the edge of the base, the firing-pin had struck towards the side of the cap, and the breech-block had caused certain curved marks on the smooth surface of the cap. Cartridges fired from the Sûreté pistol showed an exactly similar condition, every one of these characteristic marks being produced on every case fired from this pistol. Figs. 1 and 2 show these in detail and leave not the slightest doubt that this Sûreté pistol and no other was the one from which three of the shots were fired.

(B) Three other cases bore extractor and ejector marks characteristic of a Colt pistol. These were compared with a series of shells fired from the seized Colt and were found to be identical. Fig. 3 shows the mark of the extractor hook in both cases. All Colt pistols cause a somewhat similar mark by the extractor hook, but in each case there are slight differences. In this instance twenty-four Colt pistols were used as controls, and in no instance was an exactly similar extractor mark produced.

Bullets.

(A) The Sûreté pistol was rifled with six lands with a right-handed twist, and bullets fired through it show six well

marked right-handed grooves with a considerable degree of scratching between them. The bullet taken from the foot of the Sirdar had six well marked right-handed grooves of identical width and pitch, but with much less scratching between them (Fig. 4). Fig. 5 shows a plasticene plate on which the rifling marks of both specimens have been impressed. For comparison the plates have been superimposed and the identical nature of the grooves becomes at once apparent. However, in view of the lack of any characteristic fault or detail, I considered it unjustifiable to give a decided opinion on the matter, although there was obviously the strongest suspicion that the bullet had been fired from this pistol.

(B) The Colt pistol was rifled with six lands with a left-handed twist, but the barrel was in a bad state and the lands worn so that bullets fired through it did not show clearly marked grooves. It had, however, a fault in the muzzle end of the barrel which produced a scratched groove in every bullet fired through it. This lay between two of the normal grooves and was broader than those grooves. On comparison with the bullet taken from the chest of the Sirdar the same peculiarity of marking was found, and on minute examination of the two bullets the details of marking were found to be identical (Figs. 6 and 7). It could be stated with absolute certainty that the bullet from the chest of the Sirdar had been fired from the Colt pistol.

Tips of Bullets.—A comparison of the tips of the bullets seized with the Enayats with those extracted from the victims showed that the method of cutting the tips was identical. In each case the tip showed a saw cut which penetrated into the lead and a file cut above which increased the width of the saw cut. Fig. 8 shows the identical nature of the cuts.

The cartridge cases found at the scene of the crime were branded FN, SFM, and AEP, and the cartridges seized with the accused persons were of the same three brands.

From this examination it could be stated:

(1) That the ammunition used in the crime and the ammunition seized with the accused persons was of the same manufacture and calibre.

(2) The tips of the bullets had been treated in exactly the same manner to convert them into expanding bullets. The instruments used for this purpose were of the same nature.

(3) The marks on the cartridge cases and bullets proved conclusively that both the Sûreté pistol and the Colt pistol had been used in the crime, and that it was the latter which actually caused the death of the Sirdar.

The presentation of this report put an invaluable weapon in the hands of the police, for they knew then with absolute certainty that they had caught the right men and had sufficient evidence to convict them. As a result confessions were obtained from both Enayats which incriminated several other people, and eventually eight persons were definitely implicated in the crime (excluding the driver of the taxi in which they escaped).

The houses of these persons were searched, and in that of Mahmoud Rachid (an engineer) a number of tools were found, including a quantity of saws, files, and two vices, which were examined, with the following result.

The vices had pieces of zinc fitted to the jaws to prevent the teeth of the jaws marking an object held in them. In these pieces of zinc a longitudinal depression was observed which had been made by clamping a body of a size similar to a 0.32 cartridge. In this groove traces of copper were found. It must be clearly understood that, although this depression and the copper fragments could readily be caused by clamping a cartridge, it could as readily be caused by clamping any other cylindrical brass or copper object. On taking the vice to pieces a certain amount of dust was found in the joints, and in this dust numerous bright metallic particles were observed. This dust was examined for nickel, cupro-nickel, and lead, for if a bullet were clamped in the vice for the purpose of cutting the tip one would expect traces of nickel and brass in the dust as well as possible traces of lead. The analysis proved the presence of traces of copper, zinc, and nickel in the dust. The combination of these metals is an extremely suspicious circumstance, but it must be kept in mind that ordinary brass may contain

traces of nickel, and that a mechanic may quite well have traces of all of these metals amongst his tools.

Saws.—None of the saws contained traces of copper, nickel, or lead on the teeth.

Files.—There were fifty-three files in the box, varying in fineness from rasps to key files. Brass was detected on several of these files.

It will be observed that all the tools required for cutting the bullets were present in the box. The tools were of the same nature as those actually used for cutting the bullets. The dust contaminating the tools was the same as the dust that would be produced by cutting the bullets. There was therefore a strong presumption that the tools were used for this purpose, but the available information was not sufficient to enable one to state conclusively that they were so used.

In the meantime Shafik Mansour (a lawyer, and one of the accused) stated that they had been in the habit of concealing the weapons in a secret receptacle made by unscrewing the bottom panel of a door in the house of Mahmoud Rachid. A further search of Rachid's house was made, and a door was found in which the lower panel was seen to have been tampered with. This was forwarded for examination.

It was found that the panel had been originally fixed in position by two nails on one side and four nails on the bottom. In addition to the nails, glue had been used to fix the panel permanently. The panel had been removed and the nails on the side replaced by screws. The bottom nails had been left.

On examination of the wood around the cavity in the door under the panel it was seen that the nail holes in the bottom were ragged and irregular and around them there was a series of smaller and larger punctures and scratches. These marks were caused by numerous attempts to replace the panel in position after removal. In carrying this out it was necessary to force the nails in the lower edge of the panel into the nail holes, and as it was difficult to get all the nails in at the first attempt various scratches and punctures were made in the wood. About thirty of these punctures could be counted around one nail hole. Many of these were distinctly old, in others it was impossible to give any opinion as to the time when they were made (Fig. 9). There were a number of hammer marks on the panel which were probably produced by knocking the panel tight. The condition of the nail holes indicated that the panel had been removed and replaced a considerable number of times. The inside of the receptacle in the door showed a number of indentations in the wood, and it could be shown that certain of these indentations exactly corresponded with marks produced by the fore-sight and back-sight of the Colt pistol. If the pistol was placed in position in the cavity both sights exactly corresponded in position with the marks in the wood. These impressions were found in different parts of the receptacle, and indicated that the weapon which caused them had been placed in the receptacle in four different positions. Twelve sets of these marks were to be seen. There were many other marks caused by hard substances being forced against the wood, and several of these corresponded with the sights of the Mauser pistol. There were many others, however, which could not be attributed to any of the pistols seized, and the presence of certain impressions of a milled surface strongly suggested that other metal objects, possibly other weapons, had been concealed in this receptacle. The dimensions of the cavity were 33.5 by 12.5 cm. and this space (shown in Fig. 9) accommodated the four seized pistols comfortably.

From the above examination it could be stated that the panel of the door had been removed and replaced a considerable number of times, extending over a long period; that the receptacle under the panel had been used for holding certain articles which caused scratches and indentations in the wood; that certain of these indentations corresponded exactly with the sights of the Colt pistol seized in the case, and that others corresponded with the sights of the Mauser pistol, suggesting that these two weapons had been secreted in the receptacle.

At the subsequent trial the eight accused persons were found guilty and condemned to death; seven of them were actually executed and the eighth had his sentence reduced to penal servitude for life.