

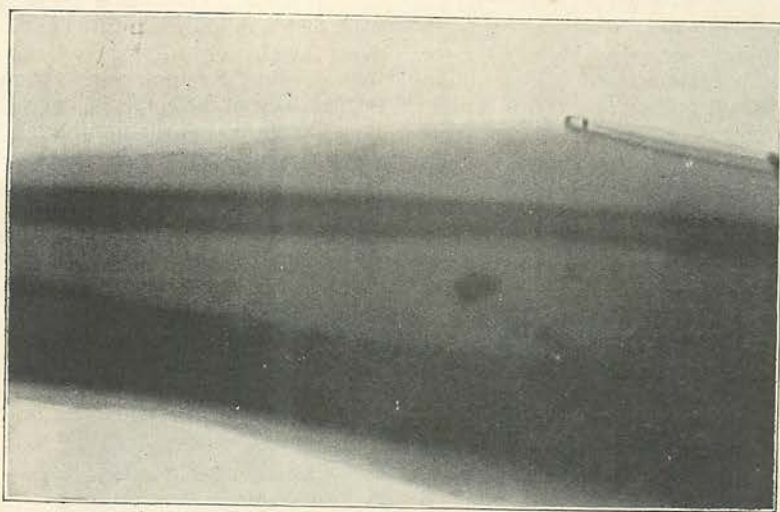
## The Röntgen Rays in Warfare.

BY HERBERT C. FYFE.



Of all the gallant soldiers who took part in the recent campaign against the Afridis on the north-west frontier of India probably none displayed more personal bravery than General Wodehouse. He is described as walking about in an almost solid stream of lead, and the extraordinary part about it is that he only received one wound, and that was in the leg. The surgeon took him into a tent in order that the missile might be extracted; and while this was being done

portion of the shot might have been left behind, he went to the base hospital at Rawul Pindi, and there Major Beevor, R.A.M.C., took a radiograph here reproduced, which showed that his surmise was correct. This picture is very interesting, showing as it does that not only bones but fibrous tissue (commonly called gristle) will sometimes split a bullet, or chip pieces from its surface. The bullet entered the General's leg in the upper part, passed obliquely downwards, and was cut out on the opposite side of the leg. In its course it passed through



1.—BULLET WOUND IN THE LEG OF GENERAL WODEHOUSE.  
*Taken on the battlefield by Major Beevor.*

the Afridis crawled up and suddenly blazed into the operating tent, putting thirteen shots through the canvas. Instead of showing any alarm the General, according to the testimony of eye-witnesses, was as calm as if he were in a London hospital, and the operation proceeded, in spite of the rain of bullets, just as if there were not an Afridi within 100 miles. Contrary to advice, General Wodehouse, although his wound was of an unpleasant jagged character, would not be laid up for long, and shortly after the injury he rode into Peshawar at the head of his brigade with the wound still unhealed. However, thinking that some

the space which (as the photograph shows) exists between the two bones; this space is filled in by a tough fibrous membrane, and as the bullet pierced it the membrane cut four pieces off its surface, as can be plainly seen.

In the upper part of the picture is a safety-pin, and this is visible because in taking pictures with the X-rays, which pierce all such material, it is not necessary to remove dressings or splints.

The case of General Wodehouse is only one of a very great number in which those marvellous rays known by the name of their



illustrious demonstrator, Professor Röntgen, have done so much to aid the surgeon in his work and to alleviate human suffering. They enable him to determine the position, size, and nature of foreign bodies in his patients, and to observe the condition of injured bones, joints, and internal organs.

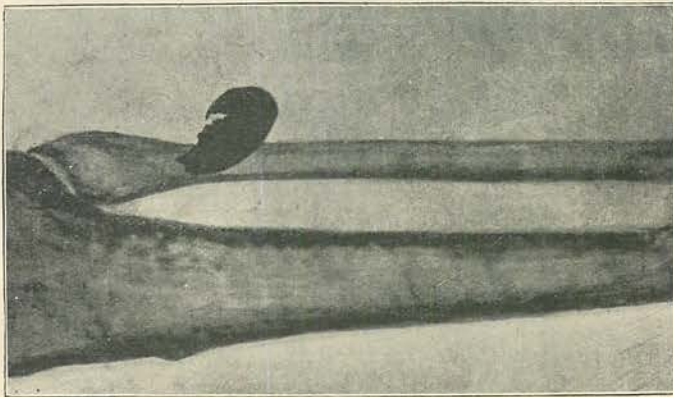
In the present article attention will be drawn to the manner in which this most valuable addition to surgical science has been applied in military warfare. It is satisfactory to know that the War Office has at length realized the importance of equipping our large military hospitals at home and abroad with an efficient X-ray outfit, and of encouraging officers of the Army Medical Service to acquire a thorough practical knowledge of radiography.

Turning now to the actual working of the Röntgen ray in warfare, some account must be given of Surgeon-Major W. C. Beevor's experiences during the recent frontier expedition to India. This was the first time that the X-rays were employed in a campaign.

"The Afridi," remarks Major Beevor, "uses bullets of almost every description, and not only bullets, but missiles of various kinds. So long as he can have a go at his enemy with something hard, he does not care a rap what that hard thing is—a stone, a piece of lead of any sort, or a piece of telegraph wire. He relies upon the telegraph wire for one of his chief amusements, because

dispensation the beneficent rays have prevented much suffering to the patient which would have occurred had probing been resorted to, and the operator may now dispense with the unsatisfactory and frequently not-too-well sterilized probe. "As a death-dealing instrument, a dirty and unskilfully used probe," said a doctor recently, "has few equals, and many lives will be saved by rendering its use unnecessary." Modern science has provided the surgeons with a probe which is painless, which is exact, and, most important of all, which is aseptic—qualities not possessed by the older, though ingenious, instrument bearing Delaton's name.

It is not possible here to enter into any detailed discussion of the various interesting cases in which Major Beevor applied the Röntgen rays in the Tirah Campaign. In very many instances he was able to find bullets by their means where ordinary methods were unavailing in disclosing their position. In the case of a Ghoorka who was shot in the back of his thigh in the first fight of Dargai, every means of probing was tried, but no bullet could be found, yet as there was no aperture of exit the surgeons knew there must be a foreign body irritating the man's leg. It would have been impossible to have found the bullet until the swelling and the irritation of the wound had subsided; in fact, it might never have subsided, and it was in contemplation to amputate the man's leg. By means



2.—BULLET WOUND IN THE LEG OF A GHOORKA.  
Taken at Dargai by Major Beevor.

he likes to chop it into little bits and have a 'snapshot' at his enemy, whether one of his own people or a heathen—*i.e.*, 'a white man.' Before the advent of the X-rays, the surgeon had to probe about in order to try and locate a bullet or other substance. In the new

of the X-rays, however, Major Beevor localized the bullet exactly, which was found to have traversed diagonally from above downwards and inwards, to have struck the bone, and rebounded in a channel of its own (No. 2).

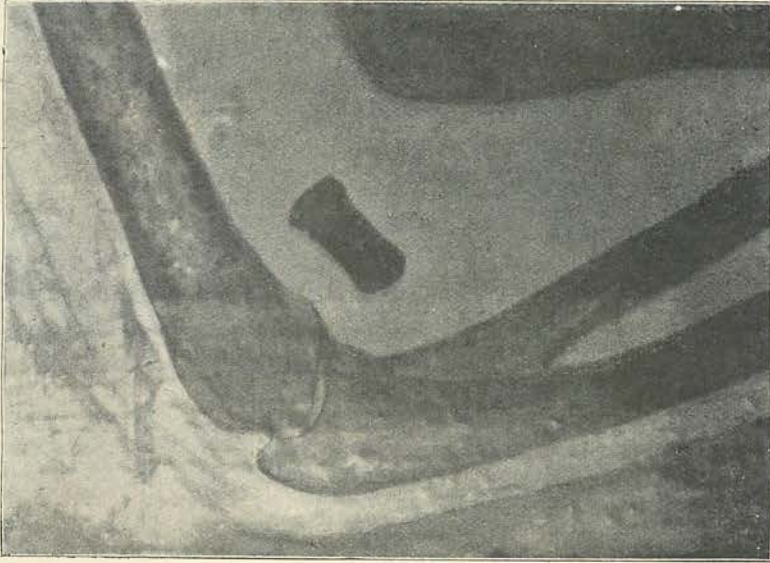
The wounded native soldiers who were



examined by the rays took much interest in the process. One was heard to say afterwards that a "sahib with a peculiar light" had examined his leg.

Another case which deserves mention was that of a man who was shot on the inner side of the biceps muscle (No. 3). He was attended by a very intelligent and scientific surgeon of the Indian army, who probed and searched in every direction without success, and then sent the patient away on a furlough

incrusted or surrounded by adventitious fibrous material. The surgeon cut down upon it, and it took him about an hour and a half to dissect the bullet from the tendonous material with which it was surrounded, and when the tendon had been massaged and stretched the man returned to duty. I suppose he got his wife, but he was an excellent fellow, and probably more pleased at being cured than he would have been at getting his pension."



3.—BULLET IN ELBOW OF NATIVE SOLDIER.  
*Taken by Major Beevor.*

for six weeks. The rest of the story may be told in Major Beevor's own words: "He returned saying that he could not use his elbow: he got it at a certain angle, and then it locked suddenly; he could throw a stone, and even use a lance, but he was a cavalryman, and all his actions were awkward because he could not get his arm extended. They thought he was humbugging. The Indian soldier, no matter who he is, is a champion at humbug when it pleases him; he is a charming fellow in every way, but if he likes to 'put on the agony,' he can do it very successfully. Well, the surgeon said to me, 'Will you have a look at this man, because he is such a good chap, and I don't think he is humbugging, but he wants to get married and go away on a pension?' We examined him with a fluorescent screen, and instantly detected the cause of his disability; the bullet had slipped down through the muscular fibres of the biceps muscle into the sheath of a tendon, and had become

By the courtesy of Major J. C. Battersby, Royal Army Medical Corps, who was in charge of the Röntgen apparatus with the Nile expeditionary force in the last Soudan Campaign, there are here reproduced for the first time in a popular magazine some photographs of great interest taken in Egypt, showing how the Röntgen rays were used for the benefit of our wounded soldiers in the recent Soudan Campaign.

The first (No. 4) shows the roin. induction coil at work. Major Battersby is here counting the seconds while a skiagram of the shoulder is being taken. The photographic plate can be seen in a specially devised wooden plate-holder under the shoulder-joint. Those who are used to experimenting with the X-rays will notice a very ingenious tube-holder.

No. 5 is a photograph of a "localizing apparatus," specially made for Major Battersby and used for the first time on active service by him during the recent Nile Expedition to Khartoum. By means of this





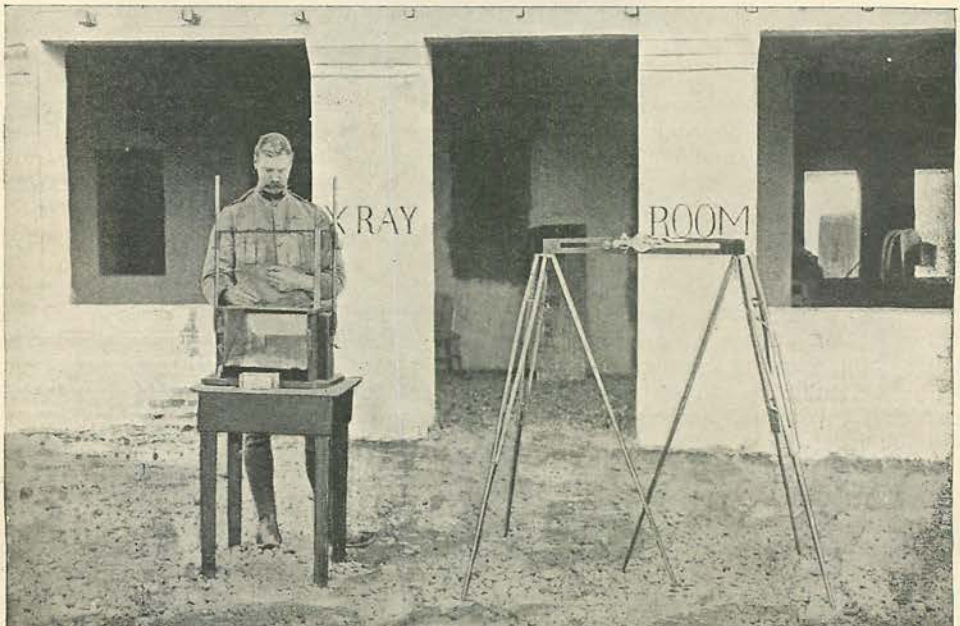
4.—MAJOR BATTERSBY AND HIS ORDERLY TAKING A  
From a] RADIOGRAPH IN THE SOUDAN. [Photo.  
(By permission of the Publishers of "Archives of the Röntgen Rays.")

instrument the Major could accurately determine the depth and exact position of bullets in the flesh, and then could operate with certainty.

The next picture (No. 6) is of a very novel character. Major Battersby used a tandem

bicycle to generate the electricity necessary for his work, and in the photograph the arrangements by which the lonely desert was illuminated for the first time with electric light by this novel method can be clearly seen.

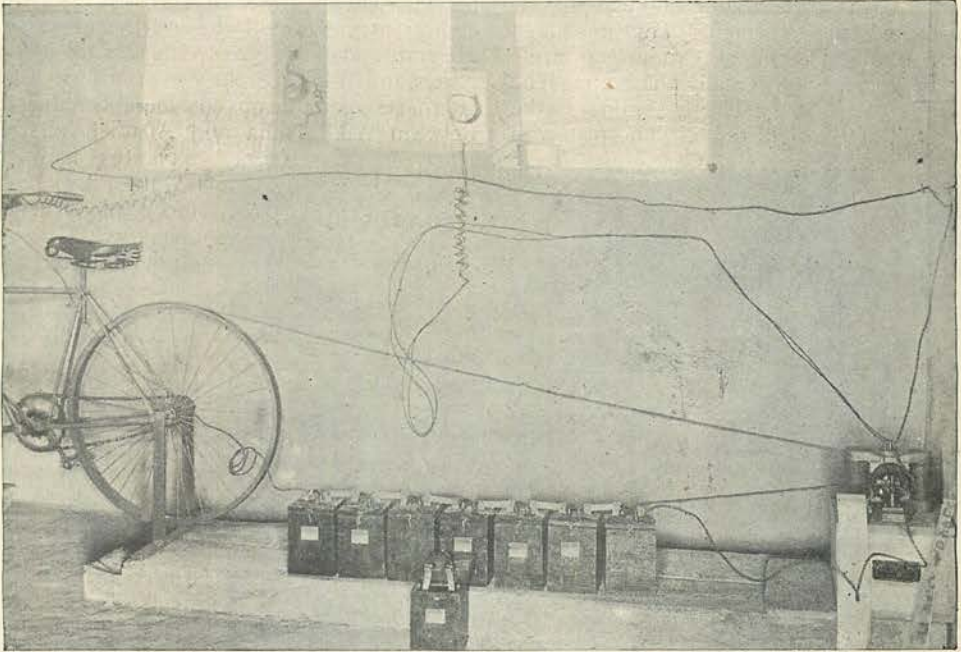
"The pulley of a small dynamo," writes



From a]

5.—MAJOR BATTERSBY USING THE LOCALIZING APPARATUS.  
(By permission of the Publishers of "Archives of the Röntgen Rays.")

[Photo.



From a]

6.—TANDEM BICYCLE USED TO GENERATE ELECTRICITY FOR THE X-RAYS.  
(By permission of the Publishers of "Archives of the Röntgen Rays.")

[Photo.

Major Battersby, "was connected by means of a leather strap with the back wheel of a specially-constructed tandem bicycle. The required velocity for the dynamo was then obtained. Having carefully adjusted the circuit with the storage battery, and also with the voltmeter and ammeter, the warrant officer took his position on the seat of the bicycle and commenced pedalling. When 15 volts and 4 ampères were registered, the switch close to the handle of the bicycle was opened and the charging of the battery commenced; as the resistance became greater, a sensation of riding up hill was experienced, and the ser-

vices of an additional orderly requisitioned for the front seat. This bicycle practice was generally carried out *in a shade temperature of 110deg. F.*, so that everyone was glad when (the switch having been turned off before pedalling ceased, in order to avoid any discharge from the battery) the machine was brought to a standstill."

No. 7 is the Nile at Abadieh (eight miles north of Berber), where the advanced base surgical hospital was situated and the headquarters of the Röntgen-ray work.

In No. 8 some fragments of a bullet are lodged in the left arm of a soldier.



From a]

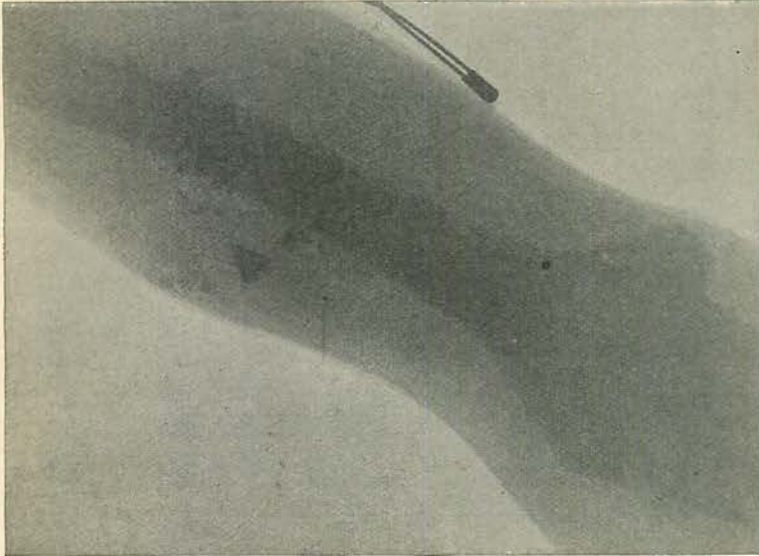
7.—THE NILE AT ABADIEH—THE HEAD-QUARTERS OF THE RÖNTGEN-RAY WORK IN THE SOUDAN.  
(By permission of the Publishers of "Archives of the Röntgen Rays.")

[Photo.



No. 9 is a very interesting photograph. It shows a bullet in the thigh. This was taken with a small 6in. coil at Omdurman, while the engagement was actually going on. The bullet is flattened out like a shilling at the lower end of the right thigh. The plate was

his instruments from the excessive climatic conditions he would necessarily encounter. He surrounded his boxes with very thick felt covers, and by keeping these constantly wet the internal temperature was considerably reduced. Between Wadi Halfa and Abadieh all the



8.—FRAGMENTS OF BULLET IN LEFT ARM OF SOLDIER.  
Taken at Omdurman by Major Battersby.  
(By permission of the Publishers of "Archives of the Röntgen Rays.")

apparatus had to travel for two days and a night in an open truck, exposed during the daytime to the fierce heat of a blazing sun. By soaking the felt every two hours the journey's end was reached without mishap. Photographers will sympathize with Major Battersby in the difficulties which beset him while working in the desert. He found that plates with the thinnest film appeared most suitable for the intense heat, but thick or thin plates could

not have been saved without the aid of an alum bath, as the water for developing was comparatively hot, and no ice was procurable; as a consequence, the more delicate shades of development had to be sacrificed. He noticed

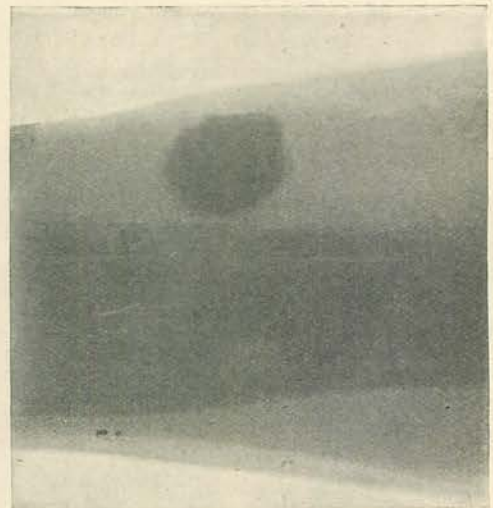
much injured by heat and sand during the process of development, and a splotch in the left-hand top corner represented some Soudan dust which, in spite of Major Battersby's precautions, succeeded in getting on to the plate.

No. 10 shows the result of a bullet wound in the left leg of a private of the Cameron Highlanders. The skiagram shows clearly the fracture of both bones, the tibia especially being very severely damaged and suffering from hierosis. Several splashes of lead can be seen in the wound.

No. 11 is a bullet wound in the left ankle of a private. In the side view the bullet is seen in the joint between the astragalus and scaphoid. The band round the ankle is a strap of lead plaster.

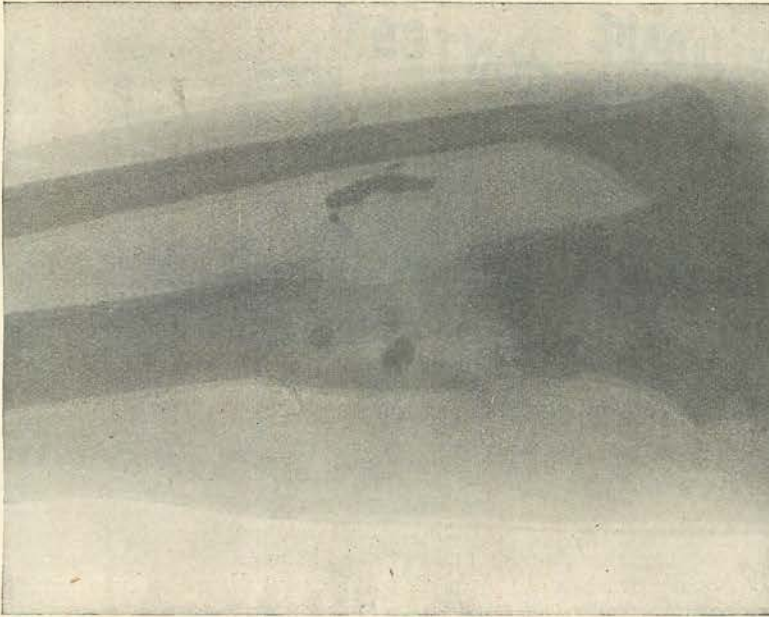
When Major Battersby decided to take an X-ray outfit to the Soudan he wrote to the Principal Medical Officer of the Egyptian Army for advice on one or two points. The latter wrote: "Beever worked chiefly in cold regions; your efforts will be carried out in intense heat, where the temperature in tents is frequently over 120deg. F."

Before leaving Cairo for the front Major Battersby took special precautions to protect



9.—BULLET FLATTENED AGAINST THIGH-BONE.  
Taken at Omdurman by Major Battersby.  
(By permission of the Publishers of "Archives of the Röntgen Rays.")





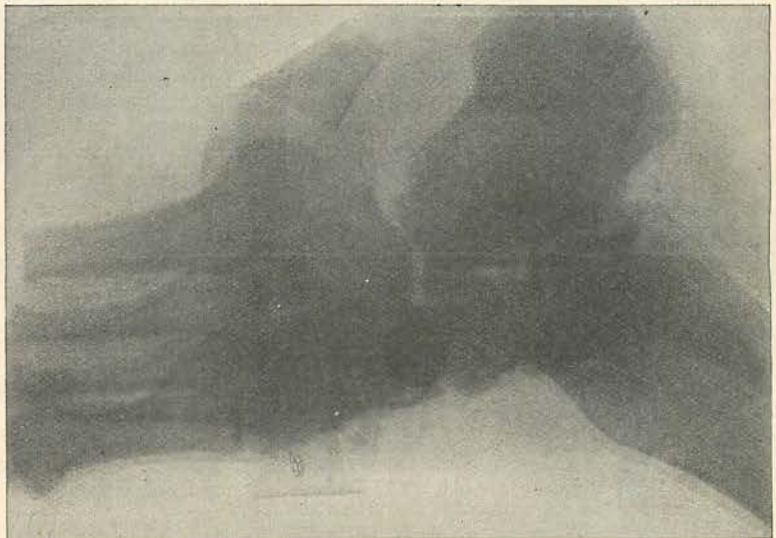
10.—FRACTURE OF BOTH BONES OF LEG, SHOWING SPLASHES OF LEAD.  
 Taken at Omdurman by [Major Battersby.  
 (By permission of the Publishers of "Archives of the Röntgen Rays.")

a marked tendency for development to proceed at a very rapid pace, making the picture flash up at once, when the greatest precautions were necessary to preserve the result. As a rule, developing work was performed at 3 a.m., and even then (the coolest time) the temperature in the mud-brick dark room varied from over *90deg. F.* to *100deg. F.* "An atmosphere laden with dust and constant dust-storms is most trying," said Major Battersby. "Eleven plates were destroyed one night by a fierce storm, which blew off the improvised mud roof. The wooden plate-holders had a disagreeable habit of shrinking, and thus allowing light to gain admission."

Major Battersby's head-quarters were at Abadieh, a small village on the Nile, about 1,250 miles from Cairo, and nine miles north of

Berber. Here the Egyptian troops had constructed a number of large, well-ventilated mud-bricked dwellings, which admirably suited the requirements of a large surgical hospital in the field. After the Battle of Omdurman one hundred and twenty-one British officers, non-commissioned officers, and men were brought back wounded to the surgical hospital at Abadieh. Of this number there were twenty-one cases in which the bullet could not be found, nor its ab-

sence proved by ordinary methods. By the help of the Röntgen rays, which were used about sixty times, the bullet was either found or its absence proved *in twenty out of these twenty-one cases.* In the odd case the patient was so ill with a severe bullet wound in the lung that it was not considered justifiable to examine him at the time.



11.—BULLET IN LEFT ANKLE. [Major Battersby.  
 Taken at Omdurman by (By permission of the Publishers of "Archives of the Röntgen Rays.")