

# Some Curiosities of Modern Photography.

## I.

BY WILLIAM G. FITZGERALD.



F all the applications of modern science, none is more interesting than the use of the camera as an aid to the detective. Here, to begin with, is an instance at once simple and amusing, showing how a suspicious photomaniac at Margate photographed his joint of mutton in order to confound his pilfering landlady (Figs. 1 and 2).

The secret of the daring and successful forgeries on Glyn's Bank was, as we all know, revealed by photography. The draft was made out for £48, but words, figures, and even perforations were punched clean out of the paper, and new pulp made and inserted. The human eye was absolutely unable to detect that the draft had been tampered with, yet a photograph showed the faint lines of the new pulp quite plainly. The forged draft was for £4,800.

Putty used by burglars in removing panes of glass; sections of banisters; drinking glasses and newspapers have been photographically treated, the finger impressions being carefully compared with those of suspects in every case. I am bound to say, however, that in this country we are slow to introduce the marvels of modern science into our warfare against the expert criminal. We have no eminent chemist like Dr. Jeserich, of Berlin, who has for more than thirteen years been engaged in continuous conflict with the enemies of society. Like his learned predecessor and teacher, Professor Sonnenschein, Dr. Jeserich takes rank among the greatest photographic detectives of the civilized world; and I propose to give as briefly as possible a few of the curious cases that have come under his notice.

Dr. Jeserich resorted to photography, or photo-

micrography, in order to have the whip-hand of other experts who disputed his microscopical observations. Eleven years ago a peculiarly atrocious murder was committed in Westphalia, and a small white hair was forwarded to Dr. Jeserich for examination. This hair was found upon the body of the victim—a girl—and was held to be of great importance, seeing that the accused murderer was a grey haired and bearded man. A hair from the beard of the latter was also forwarded for comparison.

The photo-micrographs certainly showed that the hairs were in some respects alike. Both had the same pith in the centre; both had the same air-channels, scales, and hollow spaces, and a certain fine structure of surface was common to both hairs under examination. For all that, the expert, looking at his photos., pronounced the hair found on the body to be that of an animal, solely because the pith extended to nearly the whole width of the shaft.

But what animal? Further experiments showed that the hair had been plucked from a dog: in every case photo-micrographs were compared; and, this fact ascertained, the case grew with amazing swiftness in the expert's hands.

From its colour the hair belonged to a yellow dog that was growing old; its circular section and smoothness showed that it belonged to a smooth-haired dog; and from the unclipped point it was deduced that the animal's hair had never been cut. Thus a description of the dog was worded as follows: "An old, yellow, unshaven, smooth-haired, and comparatively short-haired dog."

The man under arrest for this murder was liberated on Dr. Jeserich's evidence. Barely a year later suspicion fell upon another person, who possessed a dog exactly



FIG. 1.—JOINT OF MUTTON AS TAKEN DOWNSTAIRS BY THE LANDLADY.



FIG. 2.—THE SAME JOINT AS THE LANDLADY BROUGHT IT UP AGAIN.

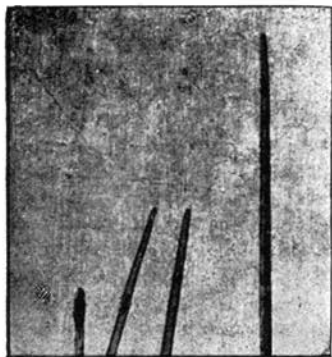


FIG. 3.—HAIR CUT AND RE-GROWN, AND UNCUT HAIRS.

coinciding with the above description. More scientific investigations followed, and about two months after his arrest the man confessed that he had murdered the girl.

That it is possible to see from the point of a hair that it has never been cut is shown by Fig. 3, which is a reproduction of the cut and re-grown point of a human hair, the three hairs at the right of it having never been cut. The photograph shown in Fig. 4 was prepared from the hairs of the victim (a woman) in another murder case. On the clothes of the two men arrested on suspicion were found certain hairs, and it was Dr. Jeserich's duty to ascertain whether these hairs corresponded with hairs taken from the head of the murdered woman.

A photograph of the point of a hair found



FIG. 4.—HAIR OF MURDERED WOMAN.

on one of the accused demonstrated scientifically that it had been taken from the victim's head. Indeed, not only was the point identical, but the shaft and root also coincided. Fig. 5 shows the well-defined, club-like root of this hair—a little thing, indeed, on which to decide life or death.

Fig. 6 shows the root of the hair found

upon the second suspect. One more photomicrographic experiment convinced Dr. Jeserich that this was the man's own hair. As illustrating the wondrous accuracy of these investigations, it is interesting to learn that suspect number one confessed his crime a few hours before his death on the scaffold.

"Are the spots upon the clothes blood?" asks the Court of the expert; "and, moreover, is it human blood?" Here again microscopic photographs of bloodstains are made, and handed round in order that judge and jury may have ocular demonstration of the difference between the blood of birds, amphibia, and fishes, and that of animals and human beings. The corpuscles of the

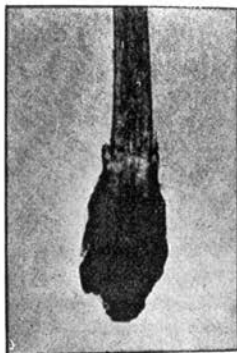


FIG. 5.—ROOT OF MURDERED WOMAN'S HAIR.

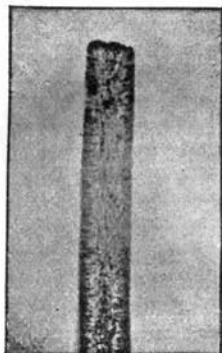


FIG. 6.—ROOT OF SUSPECTED MAN'S HAIR.

former are long and elliptical in shape, whilst those of the latter are circular (Fig. 7). The difference between the blood corpuscles of animals and men must be inferred from the size, and not from the shape. Photomicrography has revealed that there are about 150 million corpuscles in a drop of human blood, each corpuscle having an appreciable diameter of 80-10,000th of a millimetre. Of domesticated animals, the blood of a dog shows the next largest

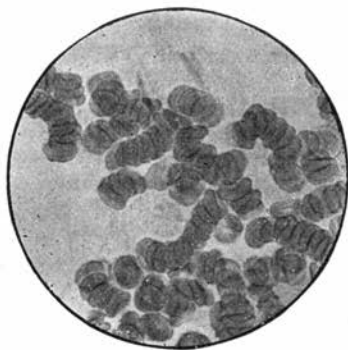


FIG. 7.—CORPUSCLES OF HUMAN BLOOD.

corpuscles, their diameter being 68-10,000th of a millimetre.

Here is another of Dr. Jeserich's cases. A murderer, upon whose axe marks of blood had been found, declared he had killed a goat eight days before his arrest; human blood corpuscles, however, were found upon the axe, and were photographically compared with authentic goat's blood. In this case, photography, besides plainly showing the difference between the corpuscles, brought other evidence by proclaiming that the axe had been wiped after the deed. One photograph, produced at the trial, showed a place in point—much magnified—on the steel of the axe. It indicated plainly the streaks caused by wiping.

The practical application of photography to the detection of the falsification of handwriting is extremely interesting. In enlarged photographic pictures, erasures, alterations, and subtle differences in inks are clearly defined.

Fig. 8 shows a portion of a bill of exchange. No special difference in the writing is noticeable, not even in the word "April." The ink appears to be everywhere of the same colour, and this photo. appears to the eye to be identical with the original itself.

The expert, however, has photographed the word "April" (Fig. 9) by means of colour

another on a bill; manipulations of figures upon cheques have been proved on several occasions; and even tricky Austro-Prussian drovers, who alter dates on their cattle quarantine permits, are bowled out while they are chuckling over their own astuteness.

One more instance, showing how photography cleared an innocent man. A forester was found dead in a wood, and by his side was found part of a vulcanite match-box, which bore certain scratches suggestive of letters. The Public Prosecutor arrested one Gottlieb Graeber, and sent the box to Dr. Jeserich to see if that expert could decipher the name of the suspected man thereon. The eminent chemist powdered the match-box with fine lycopodium and then wiped it carefully, so that the fine white particles remained in the scratches. An enlarged photograph of the box in this condition showed that the name engraved was not Gottlieb Graeber, but Adolf Langer. The latter worthy was subsequently hanged.

Dr. Jeserich was once called upon to say whether a certain old man, whose charred remains were found in the ruins of his house, had been alive when the house took fire. It was something of a poser; but after procuring a bare ten drops of blood from the old man's heart, the chemist tested them spectroscopically and found no trace of carbonic

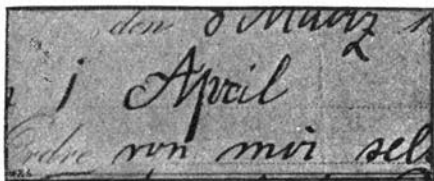


FIG. 8.—ORDINARY PHOTO. OF THE WORD "APRIL."



FIG. 9.—COLOUR-SENSITIVE PHOTO. OF SAME.

sensitive plates, which intensify the difference of colour in inks. Here one can plainly see that a falsification has taken place at the word "April," and it is possible to follow, line by line, the various kinds of ink used. The cross line of the "A"; the upper corner as well as the down-stroke of the "p"; the whole of the curved part of the "p," and the first part of the "r"; the dot of the "i"; and the down-stroke of the "l," have been made with a different ink and added to the original writing.

It is evident that instead of April, the word "Mai" (May) was originally written. In this case it was the forger's intention to make the bill payable at an earlier date.

Dr. Jeserich has had many cases of this kind. One name has been found under

oxide in the blood; consequently the old man must have been dead when the fire broke out.

I may say that the forger can never hope to baffle photography. Captain Abney, C.B., the vice-president of the Royal Photographic Society, was once requested to examine an engraving for a famous and titled collector. By means of photography, he brought out the original signature under a spurious one, which had been added to increase the value.

Nor is it generally known that at Waterlow's, the famous bank-note and cheque printers, there is a staff of photographic experts, who practically defend the Governments of the world against the skilful forger. This being so, it was clearly my duty to call upon Waterlow's chief expert, Mr. J. D.

Geddes, and this gentleman I have to thank for much valuable information.

I am indebted to the courtesy of Mr. Phillip Waterlow for the accompanying reproductions, showing bank-notes with and without a protective printing (Fig. 10). The illustration shows two note designs cut in half diagonally and joined. The upper portion shows effective photographing of the design when no protective printing is employed. The lower half shows non-effective attempt to photograph the same design when protected against photographic copying. It is by no means generally known that our own Bank of England notes can be reproduced in absolute facsimile—even to the watermarks—

the Bank's sheet-anchor, and, I venture to say, a very reliable one at that.

Foreign Governments frequently send specimens of new issues of bank-notes to Waterlow's, in order that the experts may find by photography whether it is possible to forge such notes. A fourth-rate Continental Power recently ordered a series of bank-notes from an Austrian firm, and after having been assured that they were not forgeable, even by photography, the notes were put in circulation.

Presently the whole country was inundated with bogus notes of marvellously clever design, whereupon the entire issue was called in, and a few specimens forwarded to Messrs.



FIG. 10.—HALVES OF BANK-NOTE DESIGNS, WITH AND WITHOUT PROTECTIVE PRINTING.

by means of photography. Mr. J. Traill Taylor, editor of the *British Journal of Photography*, than whom, by the way, there is no more eminent expert in the world, tells me he was once sent for by the chief engraver at the Bank of England.

The latter gentleman placed men, materials, and, above all, paper, at Mr. Taylor's disposal, and requested him to produce a few photographically forged five-pound notes, which would subsequently be tendered at the Bank counter. When the amiable Scotsman had finished, however, the last-named test was deemed wholly unnecessary, so perfectly accurate were the photographic notes. "Our sole protection," murmured the chief engraver, "lies in our paper." The paper, indeed, is

Waterlow, to see if, after all, the note could really be reproduced by photography.

The result was interesting. The note had a violet surface with a so-called protective under-printing of orange, meant to baffle the camera. Nevertheless, the London firm's expert staff quickly "got behind" the protection by using—as the forgers must have done—colour-blind plates. Specimens and photographic reproductions were then sent to the aggrieved Government, who subsequently requested Messrs. Waterlow to prepare an absolutely unforgeable note, if such a thing were possible, and forward samples.

The note produced in answer to this appeal must have been a disagreeable surprise to many expert forgers. By means of print-



ing in certain salts of iron and other chemicals, the word "Counterfeit" appeared right across the face of every one photographed; yet on any one original it was impossible to detect anything unusual.

Banks occasionally send in cheques to Waterlow's photographic staff for investigation. No matter how well words and figures have been obliterated by means of chloride of lime and oxalic acid, the searching eye of the camera, appealed to by the iron in the original ink, brings out the visually invisible characters. Even when Chinese white pigment is used for obliterating purposes, the photographic eye pierces through. The French Government, I learn, suffered severely until it adopted a special paper into which



FIG. 11.—ADULTERATING MILK: A DETECTIVE SNAP-SHOT.

strong fibre-like hair is woven. This again defeats the photographic forger, since the hairs are so strongly marked in facsimiles, that a child could detect the fraud.

Fig. 11 shows a milkman in St. James's Park caught in the very act of adulterating his milk. This is a snap-shot taken by Mr. T. C. Hepworth, of the *Photographic News*. Fig. 12 shows an extraordinary photograph taken by a

burglar, and subsequently sent to the makers of the safe that resisted his efforts.

Coming to the curious uses of photography, I enter upon such a vast field that I am constrained to be brief to the verge of abruptness. Wives have cured intemperate husbands by taking snap-shots of their lords



FIG. 12.—A BURGLAR'S PHOTOGRAPH.



in a state of intoxication, and producing the photos. at breakfast-time. Mighty bridges are tested by taking two photographs on one negative, a heavy train being run across while the second is being taken, so that the sag or depression is shown on the plate. Battleships and great buildings in course of construction are periodically photographed in order that the authorities at head-quarters may see at a glance what progress is being made.

This reminds me that Lieutenant Walter Basset, director of the great firm of Maudslay, Son, and Field, whose business is the engining of warships, tells me that photos. of machinery are constantly being sent to Japan, China, and remote parts of the world; and that sales up to a quarter of a million sterling are effected through such photographs. Moreover, these engineers take photographs of the condition of certain contracts on stated days, and claim instalments thereon from foreign Governments.

From this it is a far cry to photography as a check upon the would-be baby farmer. Yet persons who leave their children with professional nurses while travelling, often require an annual, or even monthly, photo., showing the little one's condition. Illegible

ancient manuscripts have been deciphered by powdering them with fine talc, and then taking a sharp photo. The British Museum, too, in many cases exhibit only autotype copies of such precious documents as the Magna Charta, keeping the original safely under lock and key.

Time was, indeed, when the British juror accepted a photograph as incontrovertible evidence; but everyone who is acquainted with the science knows that a photograph can be made to tell almost any story the operator pleases. When Mr. Gladstone on one occasion spoke of the absolute accuracy of photography, a humorous, if somewhat libellous, expert produced a photograph showing the right honourable gentleman loafing outside a low public-house in the Seven Dials, his hat at a rakish angle, and his appearance suggestive of the hilarity of intoxication. Personally, I have seen a lying photograph of Little Tich giving a command performance at Osborne. Blackmail by photography, by the way, is not unknown, since heads can be easily transposed. I reproduce here a photograph of a bogus mirage taken by the well-known instantaneous amateur, Mr. A. R. Dresser, of Bexley

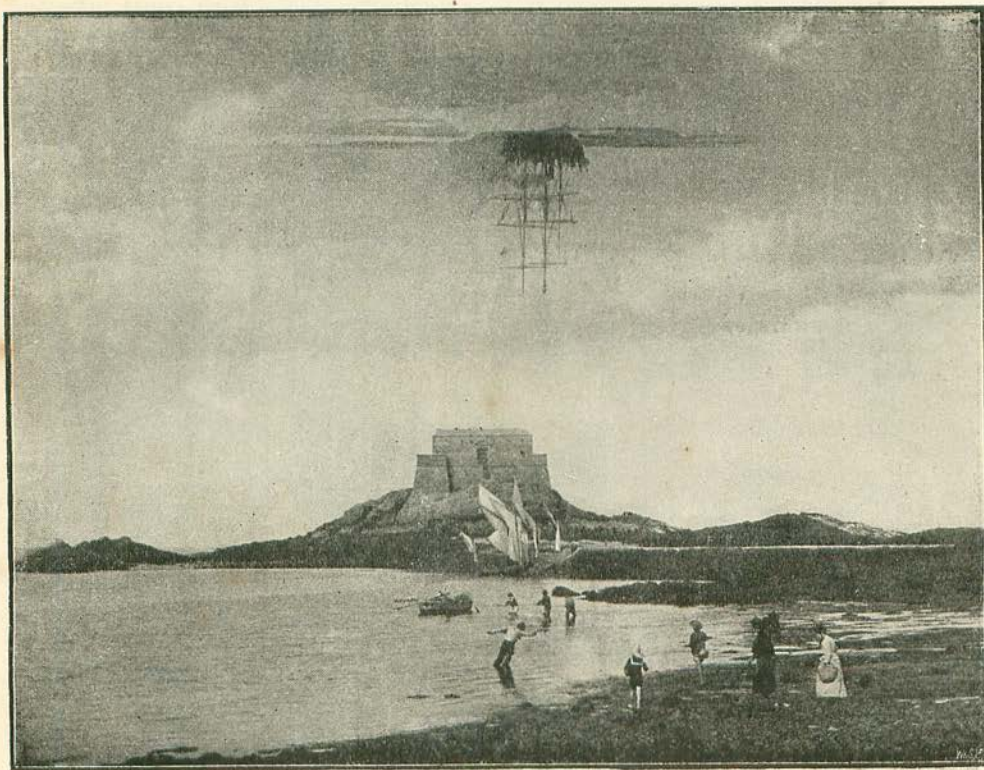


FIG. 13.—A BOGUS MIRAGE.

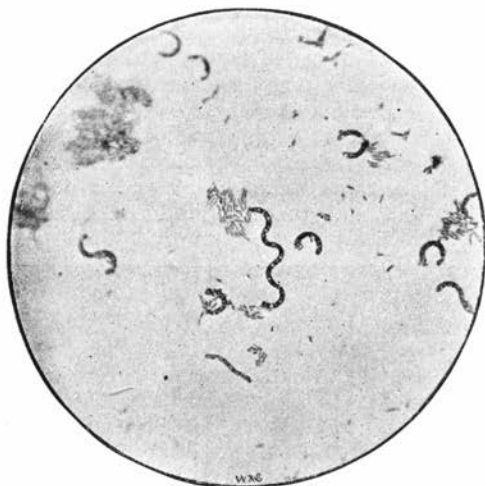


FIG. 14.—A DROP OF LONDON DRINKING-WATER.

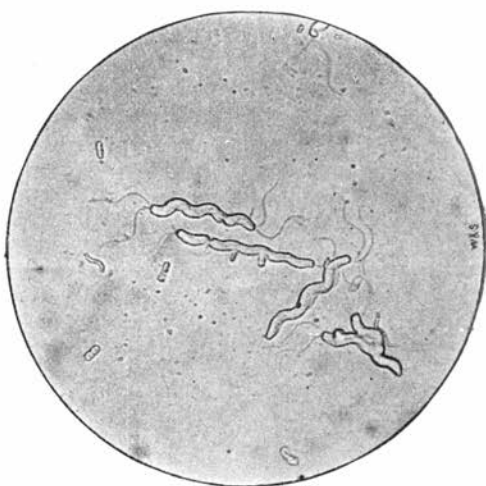


FIG. 15.—A DROP OF STAGNANT WATER.

(Fig. 13). Editors are loth to believe wonders described by unveracious correspondents, but I myself have seen more than one account of a supposed mirage in the daily papers. Possibly the narrators have forwarded photos. in support of their story. The reproduction shows a view of St. Malo, in Brittany, the mirage being a vessel passing through the *Arctic regions*! This is done by double printing.

Photo-micrography is a fascinating subject. Apart from its value as a detective agency, it is of incalculable utility to the chemist and the physician. In Fig. 14 I show a minute drop of London drinking-water, magnified 750 diameters. Fig. 15 is a drop of stagnant water, wherein one may see the lash by which the microbe moves. The lash of the microbe has a diameter of 1-200,000th of an inch.

Astounding as the statement may appear, Mr. Andrew Pringle, who supplied me with these photos., has a veritable farm, or incubator, on his premises for the purpose of propagating the deadly germs of diphtheria, cholera, and other kinds of frightful ailments. Mr. Pringle keeps his incubator always at body heat, and his queer "stock" are to be seen in glass tubes, neatly labelled.

Mr. Pringle's photo-micrographic apparatus cost

160 guineas; and his mode of photographing his "subjects" is somewhat peculiar. The bacteria are first spread on glass, and then stained with aniline dyes, after which the plates of glass are washed; the bacteria, however, retain the colouring matter. Superfluous microbes are destroyed by fire or sulphuric acid. I sincerely hope that my worthy informant will not meet the fate of Dr. Oestel, assistant at the Hygienian Institute of Hamburg, who died of Asiatic cholera, contracted while experimenting with infected water from the Vistula. He, too, had a little farm for breeding bacilli.

A most extraordinary experiment was recently essayed by Professor Marshall Ward, F.R.S. He took a sheet of glass, coated it

with gelatine, and inoculated it with bacteria, which he allowed to grow until the surface was practically covered. The professor then exposed this sheet under a negative, and wherever the light penetrated the bacteria were killed; wherein is a useful moral. Professor Ward afterwards exhibited the sheet of glass, which was in reality a photographic landscape taken on the bodies, so to speak, of myriads of microbes.

Here is one of the most marvellous photographic curios that has come under my notice; it is a photograph taken from the eye

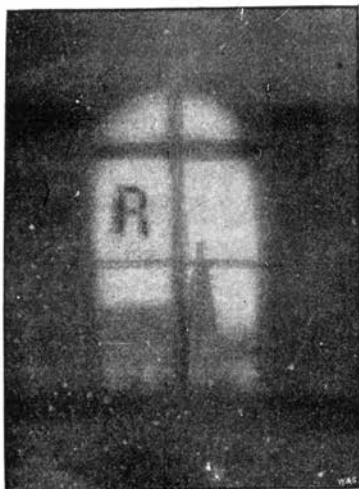


FIG. 16.—IMAGE FROM THE EYE OF A BEETLE.



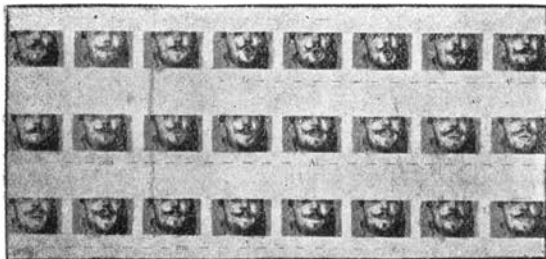


FIG. 17.—MOVEMENT OF LIPS IN SAYING  
"JE VOUS AIME."

of a defunct beetle, by Professor Exmer, of Vienna, in order to see whether the insect's faceted eyes projected one or many images on to the retina (Fig. 16). The expert set about his extraordinary task in the following way: First of all, of course, he caught his beetle, dissected the eye from the body, and placed it in glycerine on the slide of a microscope. Then he directed the slide towards the window of the laboratory—on a pane of which, by the way, he had pasted the letter R. The window is quite plainly seen. The R is comparatively distinct, too, and one gets a hazy glimpse of a church outside. I am indebted for this photograph to Mr. E. J. Wall, of the *Amateur Photographer*.

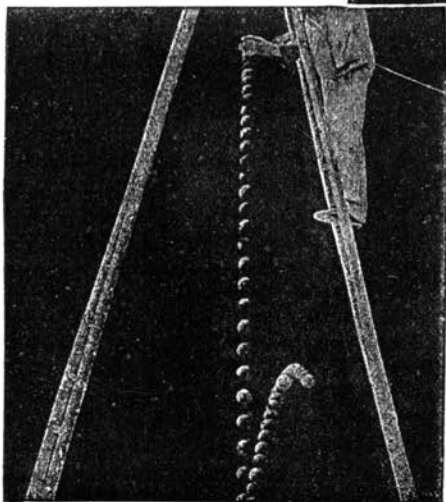


FIG. 18.—MOTION OF AN INDIA-RUBBER BALL.

Quite 50 per cent. of the students at our hospitals now adopt photography as a means of recording the details of abnormal cases, such as those of goitre, a peculiar swelling to which workmen in the limestone districts are subject, and cretinism, or semi-idiotcy, to which the Swiss are liable. There is no joke here; cretinism is induced either by

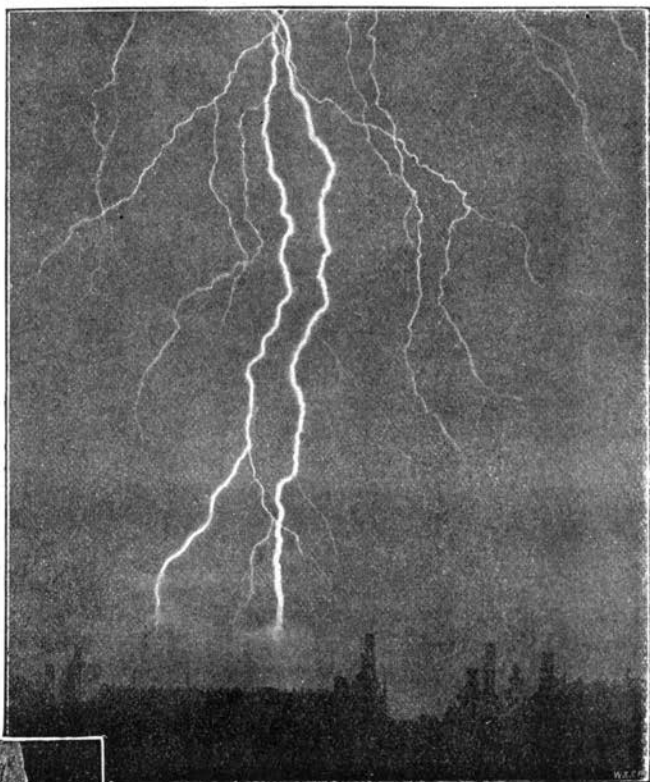


FIG. 19.—A FLASH OF LIGHTNING.

carrying heavy weights on the head, or by the use of water derived from melted snow.

The action of the human heart, the interior of the stomach, and the larynx are now photographed during life. Dr. R. Wagner's method of photographing the larynx consists of an arrangement of mirrors, the flash being provided by a magnesium ribbon lamp. The size of the actual photos. produced in this way was 0.36in. by 0.48in.; they were, of course, subsequently enlarged.

The very movements of the lips are photographed in such rapid succession, that by the aid of the zoëtrope, sentences can be read from the pictures by those who are trained to read the lip-language. The accompanying series, kindly lent by Mr. E. J. Wall, show



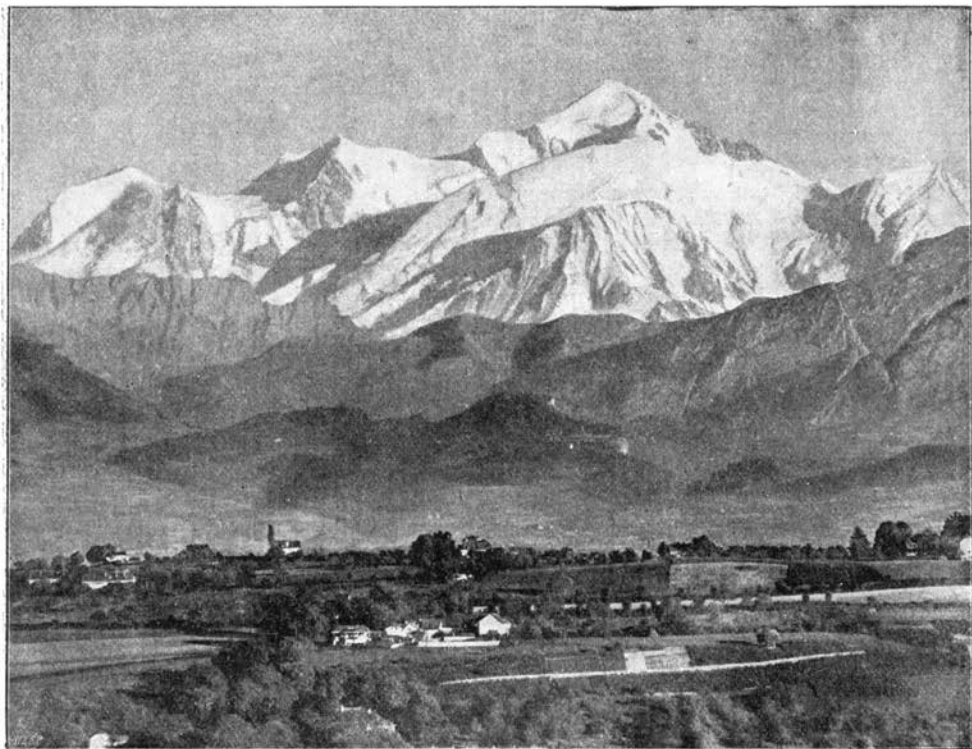


FIG. 20.—A TELESCOPIC PHOTOGRAPH OF MONT BLANC AT A DISTANCE OF FIFTY-SIX MILES.

the movements necessary to say "*Je vous aime*" (I love you)—Fig. 17. More wonderful still, the noises of the earth have been photographed by the Italian scientist, Signor Baratta, who employed an ingenious instrument consisting of a subterranean microphone, connected with a telephone diaphragm. In the face of these photographic miracles it is positively refreshing to turn to a case in which the camera was baffled. Oddly enough, the victor is—or rather was, for the difficulty has been overcome—the immortal Turner, whose series of seventy-two plates ("*Liber Studiorum*") cost a fortune to properly reproduce. The great difficulty lay in getting a photograph which should adequately reproduce the effect of the black-browns and incised lines of the original. The plates for this expensive

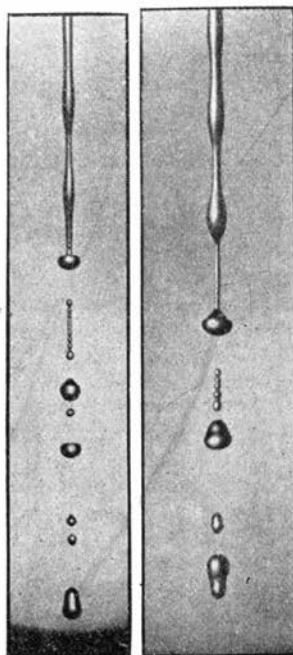


FIG. 21.—STREAM OF WATER BREAKING INTO DROPS.

and tedious experiment were lent by the Rev. Stopford Brooke.

Here is another curious photo. placed at my disposal by Mr. Wall. A man has mounted a step ladder and let fall an india-rubber ball, which has been photographed at intervals during its passage to the ground, and even after its rebound (Fig. 18).

I will merely mention such photographic curiosities as Francis Galton's composite system, whereby members of a class of society are photographed singly and then blended to obtain a typical character; a man being hanged (he is falling through the pit, his face is enveloped in a white cloth, and one of his slippers has preceded him by a few feet; this was taken in Germany); and lightning flashes, simplest of all instantaneous photographs: just

place your camera in the window, wait for the flash, and then develop your plate (Fig. 19). The double flash I reproduce, by the way, set fire to a huge factory; and after he had photographed the cause, Mr. A. R. Dresser went forth next morning and secured a picture of the result.

I have also seen Professor Marey's photo-chronographs of flying insects, obtained by an exposure lasting the 1-25,000th part of a second; and photographs of Mont Blanc, taken by M. Boissonais with a tele-photographic Dallmeyer lens at a distance of fifty-six miles, the exposure lasting seven minutes (Fig. 20). Captain Abney, the Royal Photographic Society's learned vice-president, has succeeded in taking weird moonlight photographs of Chamounix from his hotel window.

I will include in my list the beautiful pictures of falling water taken by Lord Rayleigh, with an electric spark (Fig. 21).

I wish to gratefully acknowledge here the courtesy extended to me by that eminent and popular scientist. I have also been able to reproduce Professor Worthington's wonderful photographs of a drop of water falling into a vessel of milk. The professor adopted Lord Rayleigh's method, the duration of the Leyden jar spark being the 1-100,000th of a second. The drop of water



FIG. 22.—THE DROP FALLING.

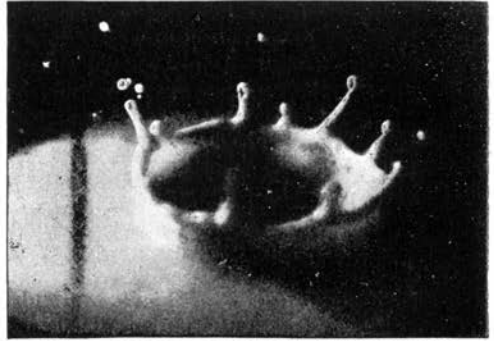


FIG. 24.—THE DROP PRODUCING A CRATER OF MILK.

is first shown falling (Fig. 22), then it is seen striking the surface of the milk (Fig. 23) and throwing up little drops from a sort of crater (Fig. 24), and lastly, a column of liquid raises itself (Fig. 25), after which the drop subsides.

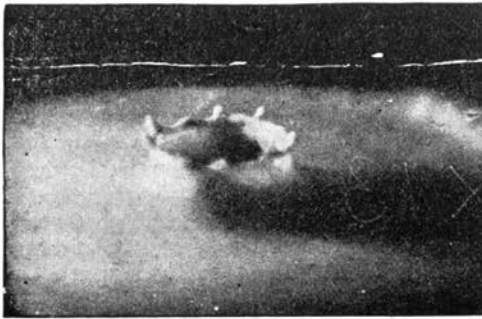


FIG. 23.—THE DROP STRIKING THE MILK.

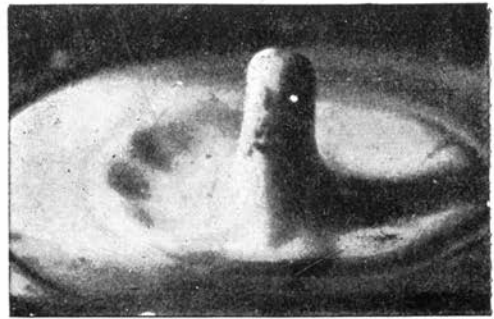


FIG. 25.—THE DROP RAISING A COLUMN OF MILK.

(To be continued.)

# Some Curiosities of Modern Photography.

## II.

BY WILLIAM G. FITZGERALD.



INSTANTANEOUS photography has indeed given us many scientific curiosities. Deeming the ordinary animal and other photographs of this description too well known to need special mention, I pass to the decapitated mule which is here depicted (Fig. 1), and which certainly is one of the most extraordinary photographs ever taken. The mule

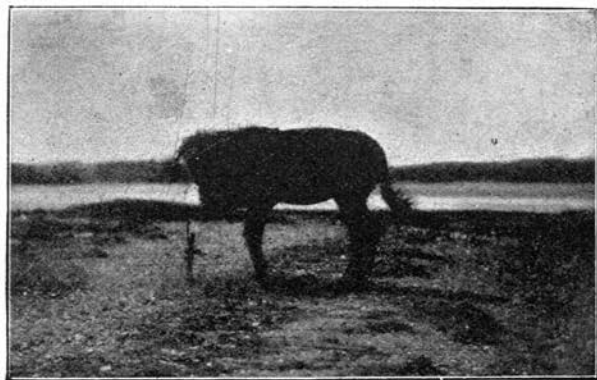


FIG. 1.—THE DECAPITATED MULE.

was an old and worthless one which was about to be destroyed; therefore it was decided to sacrifice the animal upon the altar of science, the high priest on this occasion being Mr. Van Sothen, photographer in charge at the United States School of Submarine Engineers, Willett's Point, New York.

The mule's head was to be blown off with dynamite, and the wires that conveyed the electric current to the cartridge round the animal's neck were also employed to produce a simultaneous action of a photographic shutter. As seen in the accompanying reproduction, the mule is just about to fall, and the rope by which it was tied to the stake has not had time to show the slightest movement.

For the amazing details of the photography of flying bullets and other projectiles, travelling possibly at a velo-

city exceeding 1,400 miles an hour, I am indebted to Professor C. V. Boys, F.R.S., of the Royal College of Science, South Kensington. Fig. 2 shows a bullet from a magazine rifle immediately after having left the muzzle.

Now, I have no desire to puzzle my readers with elaborate descriptions of Professor Boys' electrical apparatus; therefore, I will simply say that the photographs here given, resulting from the experiments, are only photographs of the *shadows* of the bullets.

A word concerning the electric spark used by this scientist is absolutely necessary. Not only did such sparks as were used by Lord Rayleigh and Professor Worthington last much too long, but a spark that was extinct within the  $\frac{7}{10,000,000}$ th of a second was hardly suitable for bullet photography. Professor Boys first provided an electric spark whose duration was rather less than the  $\frac{1}{10,000,000}$ th of a second; in other words, that duration bore the same proportion to a second that a second does to *four months*. While this spark lasts, a bullet from a magazine rifle, travelling at the rate of 3,000ft. in a second, cannot go more than  $\frac{1}{400}$ th of an inch.

Professor Boys set up his apparatus in one of the passages of the college. The bullets were received in a box of tightly packed bran, five feet square, after having passed through an old packing case; and the spark was produced by the projectiles themselves severing some fine lead wires and thus completing the circuit. No camera entered into the experiment. Martini-Henry and Service rifles firing cordite ammunition were used; also a choke-bore sporting gun, and a rifle carrying an aluminium ball whose speed was 2,000 miles an hour.

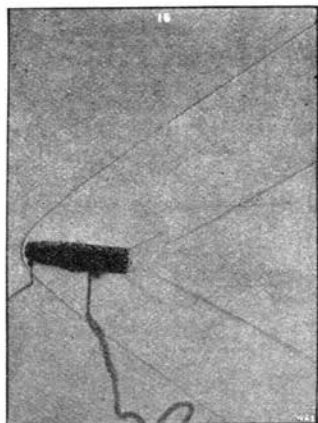


FIG. 2.—MAGAZINE RIFLE BULLET IN TRANSIT.



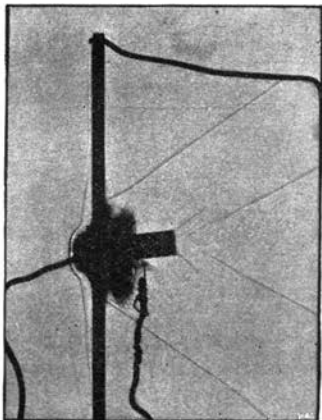


FIG. 3.—BULLET PENETRATING GLASS PLATE.

The air waves caused by the bullets are clearly defined; and in that photo. which shows a plate of glass being struck, one may see the splinters flying backwards (Fig. 3). As in the case of falling drops, Professor Boys took photographs of various stages of flight. In one picture is seen the magazine

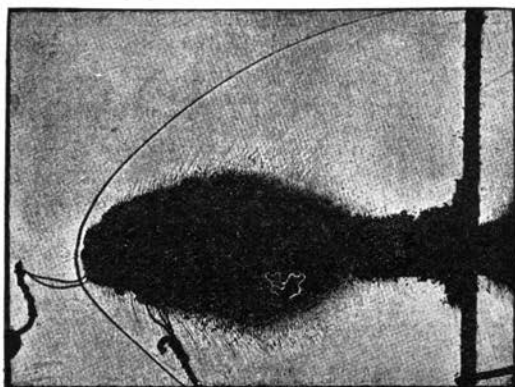


FIG. 4.—BULLET COATED WITH GLASS SPLINTERS.

bullet immediately after having passed through the glass; it is thickly coated with bristly particles (Fig. 4). A little later on we see it comparatively clear of glass splinters, but accompanied by the piece punched out on the first contact. This piece of glass has an air wave all to itself, and is evidently bent on accompanying its liberator (Fig. 5). A discharge from a shot gun is depicted in Fig. 6. The wad is seen behind the shower of bullets.

I may say that the photography of projectiles commenced shortly after the Crimean War, when experiments were conducted by the War Department at Woolwich Arsenal. That was in 1858. Wires were placed across the muzzle of a mortar throwing a thirty-six

inch shell (the "Palmerston Pacificator"), and a photograph of its flight was electrically obtained.

Submarine photographs of sponge-fishing in the Greek Archipelago have been taken

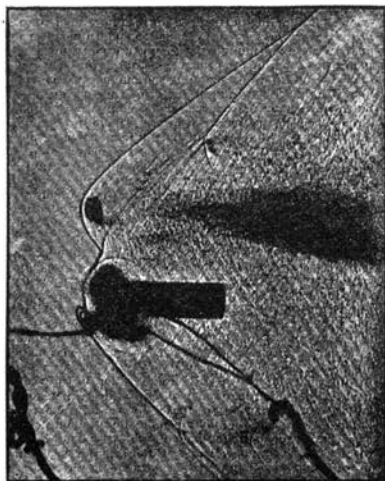


FIG. 5.—BULLET AND PIECE OF GLASS.

by a French *savant*. The accompanying reproduction (Fig. 7), illustrating this industry, was kindly lent me by Mr. W. A. Gorman, of the eminent firm of submarine engineers, Messrs. Siebe and Gorman. This curious view is said to be made up of two photographs, one taken above water and one below.

The beginning of photography in the bowels of the earth may be traced to Mr. Bretz, of the Kohinoor Colliery, Shenandoah, Pennsylvania. That clever engineer's apparatus consisted of a number of tin reflectors shaped to parabolic curves, which concentrated the light produced by from six to ten inches of ordinary magnesium ribbon.

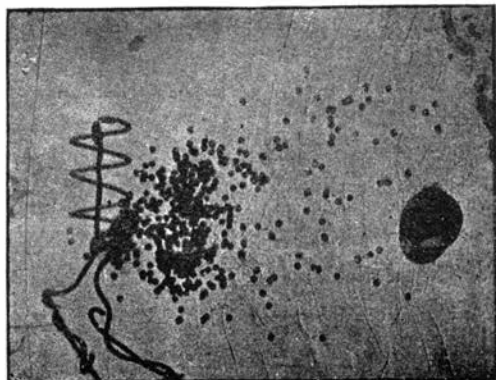


FIG. 6.—DISCHARGE FROM SHOT GUN, SHOWING WAD.

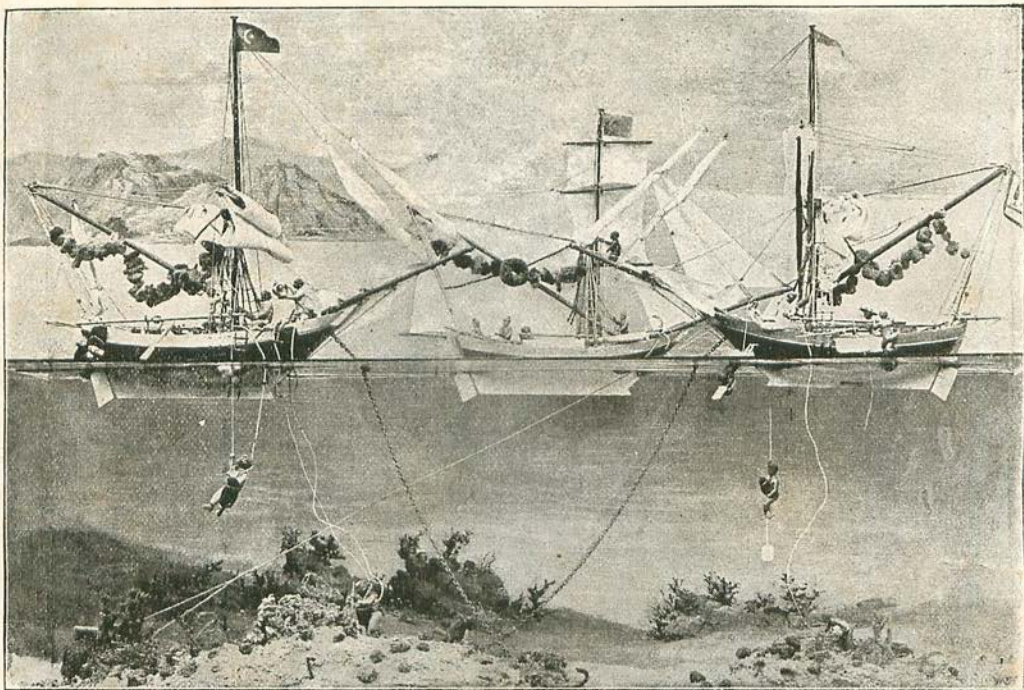


FIG. 7.—COMPOSITE PHOTOGRAPHS.

Later on, an installation of electric light was placed in the mine, the five arc lamps having a nominal power of 2,000 candles each.

Although the light failed somewhat, out of seven exposures made, five negatives turned out well. An exposure of from eight to thirty minutes was allowed, and pyrogallic

acid and carbonate of potash were used for developing. Mr. Bretz, by the way, now uses an ordinary flash-lamp, and on a recent occasion, when he burnt eight or nine ounces of powder, he succeeded in obtaining a negative measuring 22in. by 18in. — the largest subterranean photograph ever taken.



FIG. 8.—PHOTOGRAPH TAKEN FROM A MILITARY BALLOON.



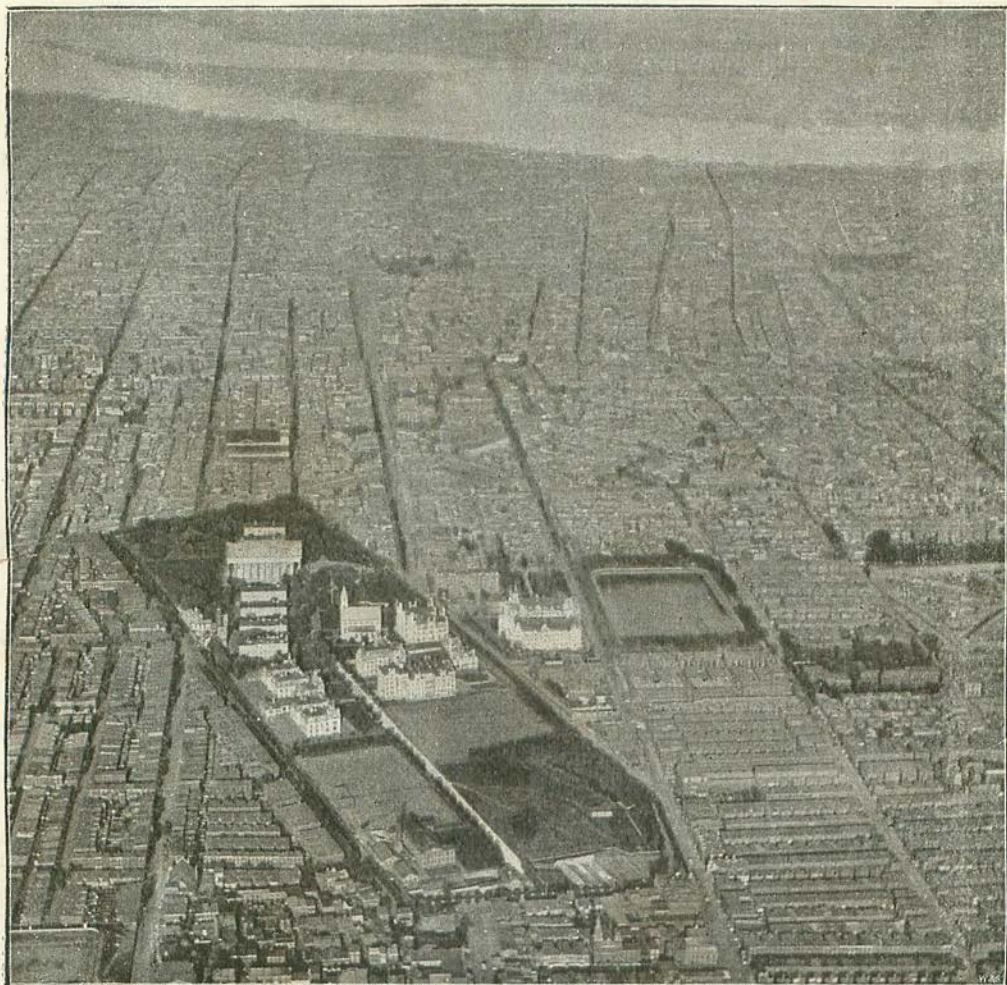


FIG. 9.—BALLOON PHOTOGRAPH—VIEW OF PHILADELPHIA, U.S., FROM AN ALTITUDE OF THREE MILES.

War balloons will no doubt figure largely in the coming European war, and as will be seen from the photographs reproduced here (Figs. 8 and 9), it is possible to obtain a complete map of the enemy's country in this way. Balloon photography, however, has its drawbacks. Captain Mantell, R.E., who turned aeronaut during the autumn manoeuvres at Aldershot, declares he had to tie his camera loosely to the car, which swayed and rocked violently.

While on the subject of war, it is interesting to note that photo-micrographic messages were in 1870 and 1871 conveyed to and from beleaguered Paris by means of pigeons. On a single film of collodion, weighing less than a grain, there were more than 3,000 despatches. Sixteen folio pages of printed matter, reduced to microscopic photographs, were secured to the tail feathers of one of these ornithological

messengers, each of whom could in this way carry a despatch of a million words if necessary. I reproduce here, by kind permission of M. Dagron of Paris, a facsimile of an original film containing photo-micrographic despatches sent from beleaguered Paris (Fig. 10).

The expert in foreign stamps has in photography a powerful ally. The searching eye of the camera brings out the crude lines of bogus varieties, and even when the micro-



FIG. 10.—MICROSCOPIC MESSAGE CARRIED BY A PIGEON FROM PARIS DURING THE SIEGE.



scope itself fails to reveal a chemically obliterated post-mark, the ghostly strokes appeal to the sensitive plate.

Galton's finger-print method of identification, which has been grafted on to the

Academy of Annapolis, in Maryland. The principal instructor could not induce the students to remain still during gun practice; they would start violently and stop their ears. Therefore the chief officer took a number of instantaneous photos., showing the cadets in "undignified and unwarlike attitudes." These pictures were hung up in the academy, and the young men thenceforward forced themselves to keep still during gun fire, for very fear of the camera.

Heirlooms, wills, and fortifications are photographed; so are all alterations made by overseers of estates abroad owned by gentlemen residing in this country. Mr. Traill

Taylor possesses an orange grove of a hundred acres in Florida, and his foreman in that sunny State hardly cuts down a tree without showing the whole thing to his master in a photograph.

The camera is even called upon to decide the genus of prehistoric fauna. When the geologist discovers indistinct marks upon certain strata, and has reason to believe that such marks were made by animals of bygone ages, he takes a photograph of the spot, and on developing his plate he finds the lines brought out most clearly. Here, for example, is a section of a rock bearing the footprint of the cheirotherium, an extinct reptile (Fig. 13). This rock was found at Storeton, in Cheshire.

Contemning the photo-maniac who causes photographs of himself, his wife, and his near relations to be reproduced on the family china, Mr. Traill Taylor tells an interesting



FIG. 11.—ENGRAVER'S HAND.



FIG. 12.—COACHMAN'S HAND.

Bertillon system for use in our police departments, has proved its efficacy in a rather curious way in America. A packet of paper money was tampered with in transit between New York and New Orleans, two seals having been broken open and the notes extracted; one seal was afterwards re-fastened by thumb pressure.

The expert who examined the package had thumb impressions taken of all the Express Company's *employés* on that route. The impressions were then magnified by photography, compared with the seal mark, and the delinquent easily discovered.

Enlarged photographs of merchants' books that have been passed by accountants have been exhibited in court, and the breaking-up of the paper fibre caused by fraudulent erasure has been clearly shown.

The reproductions shown here illustrate the system of photographing the hands of suspected criminals, for the purpose of identification. Fig. 11 depicts the hand of an engraver, and Fig. 12 that of a coachman. The hands of the latter distinctly show the corns caused by the reins.

A curious use was found for photography at the Naval



FIG. 13.—PREHISTORIC FOOTPRINT REVEALED BY PHOTOGRAPHY.

story of the wonders of applied photography. An English gentleman had a big apple-tree, of which he was inordinately fond, trained against his garden wall. Fearful of pruning it himself, however, he took a sharp photo., and sent it to an expert gardener at Hyères—it might have been Timbuctoo. In due course the photo. was returned, showing certain pencil marks through numerous branches. These the gentleman had lopped off by a "handy man," while he himself directed operations, photograph in hand.

In many Continental cities where passports are required, the holder's photograph is impressed upon the document; and at Tacoma, in Washington, electors are photographed as they record their votes.

It may interest my lady readers to know that famous costumiers seldom place in the window their choicest confections in costume, or the last "sweet thing" in bonnets, lest perhaps the pirate pattern-seeker should come along with his or her (generally her) kodak. Then, again, patterns of costly lace have been photographically stolen without a camera at all, but simply by means of a sheet of paper rendered sensitive with bichromate of potash or nitrate of silver, and then dried. A sheet of glass completes the apparatus.

Here is a curious photograph taken by Mr. Hepworth with a vertical camera (Fig. 14). It illustrates an equally curious industry carried on by the wily Chinese at the expense of the guileless "foreign devil." Living pearl mussels are taken from the Chinese rivers; little balls of wax or leaden gods are introduced into the shells, and then the mussels are returned to their native element. In due time the pellets and figures become coated with pearl; the latter are sold at a huge profit, while the former are palmed off upon unsuspecting Europeans as real pearls of great size and faultless shape. The illustration shows shells filled with "pearls" and the little figures of the god Buddha.

That eminent photo-micrographer, Mr.

Andrew Pringle, of Bexley, and his brother, Mr. R. Hunter Pringle, were recently employed in an interesting manner by the Royal Commission on Agricultural Depression. These gentlemen toured through the Maldon Division of Essex, taking photographs of land and farms that had gone out of cultivation. They returned with quite a host of pictures showing thistles growing in fields, and ruined farmhouses, which appealed to the Commission far more powerfully than the most eloquent speech would have done.

The camera, as everyone knows, is one of the most indispensable articles in a war correspondent's outfit; and as the battlefield of the future will be comparatively smokeless, the correspondent will be enabled to make still greater use of photography. Mr. Melton Prior states that he can make a sketch in less time than he can take a photograph; yet the last time he was "on the war-path," Mr. Prior carried three cameras in his saddle-bags.

By the way, if the records of the photography of the dead are not cheerful, they abound in interesting detail and even comic incident. About five years ago a well-known Oxford Street photographer was sent for to photograph a woman in her coffin. When the picture was developed, one finger was found to be out of focus. "Now," argued the photographer, "if the body had slipped, the whole would be out of focus; therefore I conclude that only the finger moved." He drove back in a cab with a doctor, and it was then found that the woman was not really dead, but merely in a sort of a trance. This is a fact.

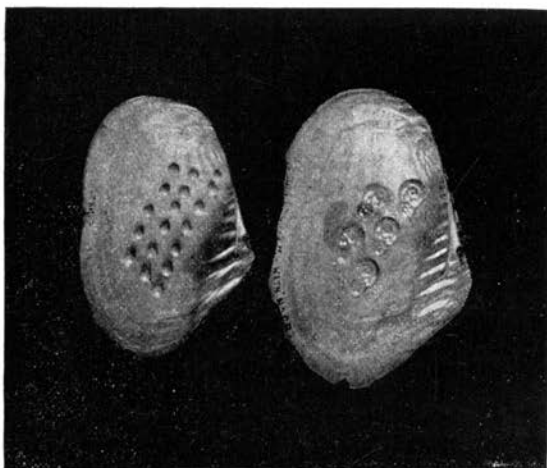


FIG. 14.—HOW THE CHINESE MANUFACTURE PEARLS.

The vagaries of the camera, too, are distinctly amusing. Mr. F. P. Cembrano, of the Royal Photographic Society, shows a photo. of a tiny burn, or brooklet, in Scotland, on the banks of which is an equally small village. Yet up this little rill of water is steaming a colossal ironclad of the *Royal Sovereign* class, with all her mighty guns and fighting towers, and thousands of tons dis-

placement. Another whimsical photo. depicted a castle in Edinburgh, out of the topmost windows of which a number of sheep were placidly gazing.

The photograph reproduced in Fig. 15 simply demonstrates that photography can,

been held very close to the lens. The rule, of course, was taken some distance away.

One of my authorities was once engaged by both sides in a law case. A company, whom I will call the City Lands Improvement Company, wanted to abolish a certain court leading from Lombard Street to King William Street, and were willing to establish in its stead a passage through one of their own buildings. The company's plea was that the court was a dingy, not to say dirty, one, and furthermore, that it was haunted by loafers of questionable character.

Counsel for the other side, representing merchants having offices in the court, stoutly maintained that the passage was well lighted and eminently respectable. Photographs were handed in from both sides. The first photo. showed a narrow, disreputable-looking alley, strewn with rubbish and fallen hoarding; the other picture, however, showed the court in dispute to be a fairly broad, well-lighted City thoroughfare, frequented by merchants of thriving appearance. These photographs were taken for the House of Lords Committee, but the matter was amicably settled.

Here is another case: The Shuttle Machine Company vacated their premises in Cheapside, and another sewing-machine dealer moved in. In order to trade upon the established reputation of the company, the second tenant left the old name on the windows and over the

door, but added the word "Late" in very minute characters for his own protection.

The Shuttle Company waxed wroth, brought an action, and engaged a photographer to take a view of the offending shop-front from a tailor's window opposite. When this photograph was produced in court, it was handed to the presiding judge with a powerful glass, whereupon his lordship was able to perceive that what appeared to the eye to be a mere ornamental dash, was in reality the protecting word "Late." The photographer himself, by the way, was not aware of this. The aggrieved sewing-machine company secured an injunction.



FIG. 15.—"CURFEW SHALL NOT RING TO-NIGHT."

by a combination of negatives, be made to depict that which is *ipso facto* impossible. The beautiful story of the girl who in this way prevented the Curfew Bell from ringing in order to delay the moment of her lover's execution is too well known to bear narration in detail.

The amateur photographer who is also an angler is well aware that his camera will back him up when boasting of his piscatorial prowess. One photo. I saw represented a huge fish, the length of which appeared to equal that of a 2ft. rule, which was also shown. In reality the "take" was a little dace or carp; and while being photographed it had



In Fig. 16 we have depicted a submarine explosion on the occasion of the removal of a dangerous rock at Hellgate, New York. Our next reproduction (Fig. 17) shows a tremendous dynamite explosion during the destruction of an old dock wall at Newport, Monmouthshire.

The most interesting law case ever decided by photography was that intrusted to Mr. J. Traill Taylor. The facts were as follows: A collision occurred in New York Harbour between a White Star and a Cunard liner; and when the collision seemed imminent, an amateur photographer on board the latter vessel took a snap-shot of the approaching liner. Both companies put in claims for damages.

First of all, Mr. Taylor procured the dimensions of both steamers; the approximate speed of both at the time the photo. was taken; also the height of the masts. He then retired to a park at Crouch End, armed with compasses and measuring lines, and, subsequently, worked out a little mathematical problem, the vessels being represented by bricks.

After a trip to the Mersey to satisfy himself on a few minor points in the construction of a Cunarder, Mr. Taylor worked out his theory, based upon the fortuitous photograph, before the combined committees of both



FIG. 16.—A SUBMARINE EXPLOSION.



FIG. 17.—BLOWING UP DOCK WALL, NEWPORT, BY DYNAMITE.

companies, using books this time to represent the two vessels.

One of the most eminent architects in the kingdom once showed the accompanying photograph (Fig. 18) to a number of his colleagues. Had they ever seen such

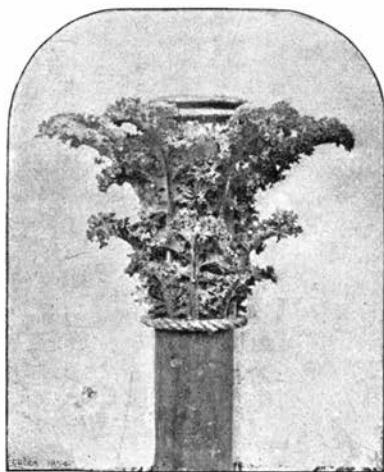


FIG. 18.—THE MYSTERIOUS CAPITAL.

an exquisitely carved capital? They had not; and they said so. Then arose disputes as to the precise nature of the architecture. Finally sundry big wagers were made, and then the architect gravely proceeded to explain the structure of the column



FIG. 19.—HOW THE CAPITAL WAS MADE.

and its capital. This he did by producing his Malacca walking-stick and a few sprigs of succulent brocoli, such as are seen in Fig. 19. Naturally enough, however, after many abstruse disquisitions on

mediæval architecture had been given on the subject of the mysterious pillar, this explanation of the photograph was received in silent disgust.

That photography has made many changes in the painter's art, few can deny. Had Landseer been a kodaker, the paws of his massive lions in Trafalgar Square would not have been so faulty as they are; nor, possibly, would the eyes of his horses and dogs have been so large. In a general way, an artist can tell when photography has entered too largely into the conception of a painting; for one thing, the perspective is somewhat distorted. However this may be, I am satisfied that "*Photography versus Art*" is a sore subject with those concerned. Lady Butler was, I believe, the first English artist to portray a horse walking with three legs on the ground. Consequently, a small force of police were required to keep back the crowds that came to get a glimpse of her picture, "*The Roll Call*," when it was hung. Lady Butler took Meissonier as her authority for this artistic innovation; and it is common knowledge that the French Government provided that great master with a little railway, in order that he could travel along the road with horses, sketching as he proceeded.



FIG. 20.—"CANINE LEAP-FROG."

As will be occasionally seen in this article, certain experts devote themselves to particular branches of photography. The name of Captain Hayes is associated with equine photography, and he himself has travelled all over India, China, and South Africa, armed with a hand-camera. As the result of an argument with Mr. John Charlton, the chief artist of the *Graphic*, Captain Hayes once produced a photograph of a horse with all four legs on the ground, yet showing a decided sense of movement.

All sorts of odd means are devised to make horses that are going to be photographed look smart. The official photographer at the Royal Military Repository tells me he has a shrill whistle blown at the critical moment; or the sergeant-major who assists him opens an umbrella sharply, causing the horse to prick up its ears.

Fig. 20, "Canine Leap-frog," by Mr. Dresser, of Bexley, is one of the most successful instantaneous photographs ever taken. Infinite patience and ingenuity are required to get such pictures.

Another famous animal photographer, Mr. Frederick Haes, found that the best way to get a good photo. of a rhinoceros was to direct the animal's attention to a boy clad in a bright blue coat. "Wild animals," adds Mr. Haes, "have a strange objection to a man in his shirt-sleeves."

Certainly one of the most interesting marvels of photography is that the mysterious eye of the camera sees objects which are absolutely invisible to the human eye, the telescope, or the microscope.

An expert can take a sheet of paper prepared with gelatine and bichromate of potash, and can photograph on it a secret letter, containing, it may be, treasonable matter. This done, he may sit down and write a garrulous letter about the crops, the weather, and the baby's health. The recipient, of course, cares for none of these things, but wets the sheet with plain water, holds it up to the light, and literally reads between the lines. When dry, the document defies detection, and it can be moistened and dried again as often as the recipient pleases.

Mr. Traill Taylor tells me that a room which appears

visually quite dark may be full of the ultra-violet rays of the spectrum, and, paradoxical as it may seem, photographs may be taken in that dark light. Dr. Gladstone, F.R.S., has traced invisible drawings on white cardboard, the "ink" used being such fluorescents as mineral uranite and disulphate of quinine. When photographed, the drawings have come out bold and clear.

Mr. Taylor relates a funny story concerning a young lady of scientific, and at the same time mischievous, proclivities.

This young lady painted upon her fair brow with fluorescent liquid a death's head and cross-bones, and she then demurely visited a photographer's to have her portrait instantaneously taken. All went well until the operator had developed the plate, and then it became evident that he was having a row with his assistant, whom he blamed for coating a dirty plate. After apologies, a second negative was taken, and then the operator fetched his master from downstairs. A third attempt was made, when sounds of a heated altercation were heard, followed by a scuffle.

The photographer, pale and excited, requested his fair sitter to withdraw, as *there was electricity in the air* which was unfavourable to photography. The lady insisted on taking away a negative showing the hideous insignia on her forehead. It is a fact that the photographer requested the vicar of his

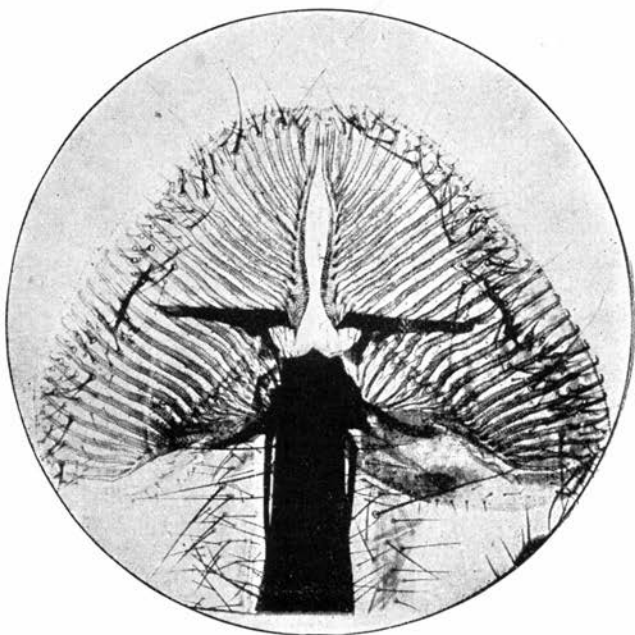


FIG. 21.—TONGUE OF A BLOWFLY—MAGNIFIED.





FIG. 22.—A SPIRIT PHOTOGRAPH.

parish to say a few prayers in his studio, after the departure of his mysterious visitor. I reproduce here a fair specimen of the result achieved from the union of the microscope and the camera. Fig. 21 represents the tongue of a blowfly, of course, magnified many hundred diameters.

Without expressing an opinion of my own, I should like to touch upon the so-called psychic or ghost photography, conducted in the presence of a spiritualistic medium. When one learns, by the way, that Professor Crookes, F.R.S., and Dr. Alfred Russel Wallace

have investigated the subject, believe in it, and possess collections of spirit photos., one is almost tempted to think that there must be "something in it."

The best-known experiment in ghost photography was conducted by Mr. Traill Taylor in the presence of the well-known medium, Mr. David Duguid—a truly reassuring name, at any rate. Mr. Taylor not only used his own unopened packages of dry plates and conducted the developing himself, but he set a watch upon his own camera in the guise of a duplicate one of the same focus. And yet ghosts appeared—spirits of departed friends, all nicely draped (Fig. 22).

But, perhaps, when I turn to stellar photography the average reader will be able to form a more adequate conception of the marvels of modern photography.

As well as peering into the depths of the earth and the sea, and making visible the invisible, the omniscient eye of the camera defeats the telescope on its own ground, or, rather, in its own element. In an area which did not contain one visible star, ten thousand have been found by photography. We have photos. of lunar mountains, and egg-shaped masses of hazy nebulae which the human eye, aided by the most powerful telescope in existence, could never have discovered (Fig. 23).

Here is the weapon of the New Astronomy. A gigantic telescope, fitted as a camera, and carrying a plate of great sensitiveness, is

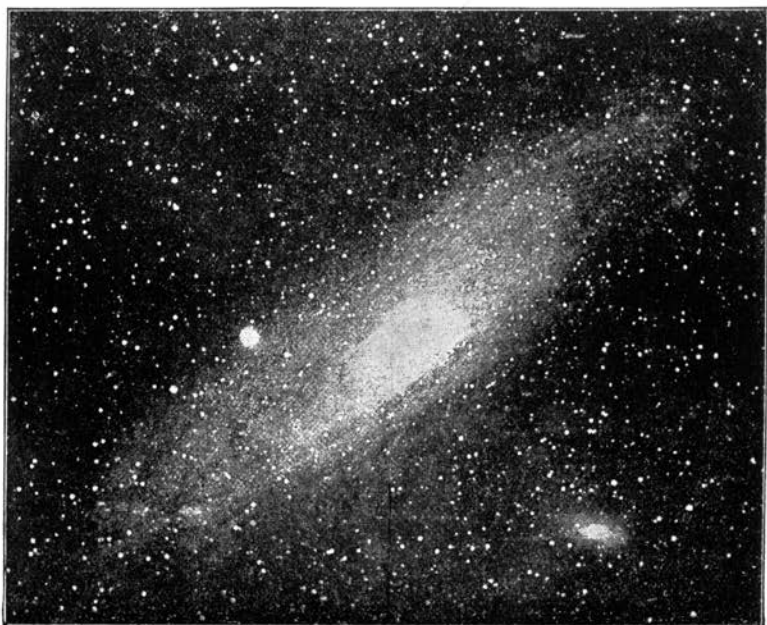


FIG. 23.—A TELESCOPIC STELLAR PHOTOGRAPH.

exposed in the ordinary way, as a telescope only would be. The apparatus is driven by a huge clock, which causes the telescope to follow the stars for fifteen or twenty minutes, during which time a vast number of otherwise invisible astral bodies impress themselves on the plate. The eye of the camera, be it noted, does not tire; the longer it gazes, the more its sensitive vision takes in. The very composition of the stellar worlds has been determined by modern photography.

The man who has tackled the photography of animal locomotion in the most extraordinary, and at the same time most thorough, manner is unquestionably Professor Muybridge, of Pennsylvania University. It is interesting to learn how this scientist came to adopt the business of his life.

In 1872, Muybridge was official photographer to the United States Government on the Pacific Coast, and while at San Francisco, a dispute arose between two wealthy residents as to whether a fast-trotting horse had at any moment his four feet off the ground.

After experimenting for a few days, taking as a model the celebrated trotting horse, "Occident," who trotted a mile in two minutes and sixteen seconds, about a dozen negatives were obtained, which plainly showed that for some portion of his stride, at least, the horse was entirely free from contact with the ground. Indeed, seeing that some trotting-horses take a twenty-foot stride, it is difficult to understand why the dispute ever arose.

The apparatus now used by Professor Muybridge consists of an electrically controlled battery of twelve cameras, so arranged

that a regulated succession of exposures can be made in any given time. When completed, his pictures are combined in an instrument of his own invention called the zoopraxiscope, and projected on to a screen by an optical lantern, the result being that one finds it hard to believe one is not actually looking at the moving original.

When the professor lectured at the Royal Institution, there were among his audience the Prince and Princess of Wales and their daughters, the Duke of Saxe-Coburg, Sir Frederick Leighton, Professors Huxley, Gladstone, and Tyndall, and the late Lord Tennyson. On the screen before this imposing assembly horses walked, ambled, and leaped over hurdles in a perfectly natural manner; athletes and kangaroos jumped; birds flew; monkeys climbed trees; and ladies danced and carried on a fan flirtation. Yet the majority of the photographs, seen singly, seemed to depict ungraceful and impossible attitudes. Fig. 24 shows a really extraordinary series of Muybridge's photographs. The famous mare "Sallie Gardner," belonging to the well-known American sportsman, Leland Stanford, is shown running at a high rate of speed over the Palo Alto track. The negatives of these photographs were made at intervals of 27in. of distance, and about the 25th part of a second. They illustrate consecutive positions assumed in each 27in. of progress during a single stride of the mare. The vertical lines shown in the photograph were 27in. apart; and the exposure of each negative was rather less than the 2,000th part of a second.

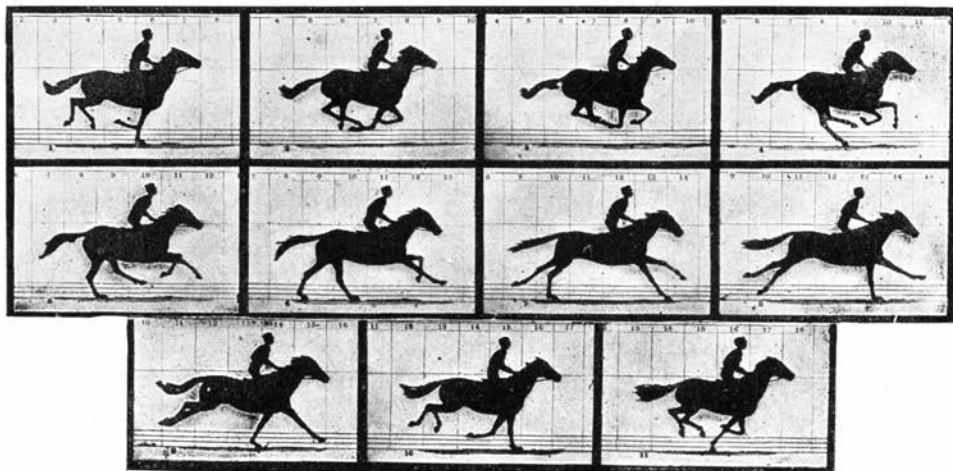


FIG. 24.—THE HORSE IN MOTION.