

**LEONARDO DA VINCI'S HIGH ANGLE MORTAR.**

Leonardo da Vinci was one of the greatest and most versatile men who ever lived. When universality of talents are considered, all must stand aside in Leonardo's favor. During his lifetime, 1452-1519, every human attainment was his, and nearly every honorable pursuit, barring the commercial, was followed by him with more or less success. He was painter, sculptor, architect, poet, musician, philosopher, psychologist, author, critic, traveler, aeronaut, mathematician, physicist, chemist, geologist, mineralogist, astronomer, anatomist, physiologist, surveyor, topographer, engineer (civil, mechanical, mining, naval and military), and inventor.

We cannot concern ourselves with any of the achievements of this remarkable man, except to briefly refer to one of his most curious inventions, which is the direct precursor of the modern high angle battery which we illustrate elsewhere.

In his capacity of a naval and military engineer Leonardo showed his love for the terrible. In the memorable letter intended for the Duke of Milan, which is one of the curiosities of the Renaissance, he describes the various engines of war which he could fabricate, and the means by which he could overcome the enemy. Leonardo has left hundreds of sketches of catapults, ballista, gigantic crossbows, breech-loading cannon, mitrailleuses, serpentine organs, and steam cannon. The breech-loading cannon antedated Leonardo, though he made substantial improvements in it. He devised breech-loading mitrailleuses for giving both a parallel and a fan-shaped fire. He it was who discovered the secret of the conical rifle ball, and he invented explosive bombs. When it is said that Leonardo understood the principles of the very modern "built-up" gun, it may well be said that this might be called his greatest title to fame as an inventor. He has left minute sketches of guns reinforced by hoops shrunk on, and even of wire guns.

The high angle mortar shown in our engraving is one of the most curious of military engines illustrated in Leonardo's manuscript. It is taken from the "Codex Atlanticus," which is now in Milan. Like all of Leonardo's sketches, it is accompanied by notes written backward in a crabbed hand. He divides the ordnance question into fortress, siege, field and marine ordnance, and the mortars shown belong to the class of siege pieces. In principle they resemble the mortars which form the subject of our first page engraving. They are stumpy mortars mounted on trunnions, and are elevated or depressed by means of a quadrant in which pins are inserted which mesh with the worm, which is actuated by the handles at the end of the shaft, as shown by the small detail drawing. These short cannon were known literally as "throwing kettles," and were intended to hurl explosives and burning shot. Hollow shot could be used with these devices, as is shown by the left half of the drawing, which we do not illustrate.

**Handwriting and Forgery.**

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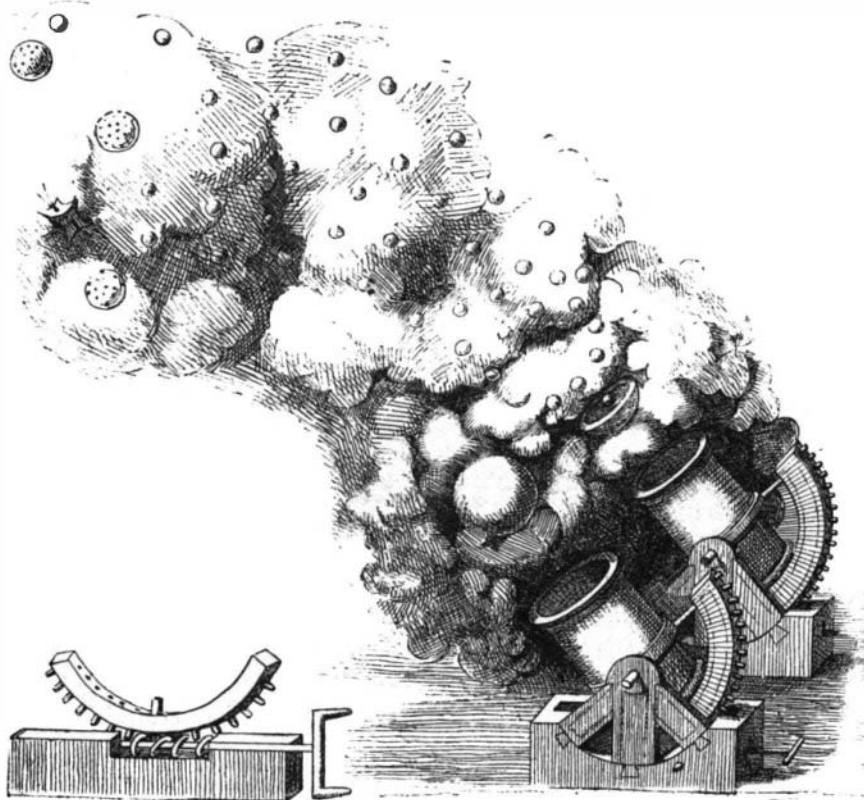
The attention of the world has recently been attracted to the subject of forgery by the Dreyfus trial in Paris and the suit of Jay vs. Sykes in London. In the latter case, Sir Tatton Sykes, a rich baronet of Yorkshire, was the nominal defendant, but, so far as the public was concerned, Lady Sykes was the real defendant. The evidence led to the dreadful conclusion that she had forged her husband's name to promissory notes amounting to \$75,000, which she had sold to the notorious usurer David Jay, who, as plaintiff in the suit, was trying to enforce payment of these notes. All knowledge of the notes was denied by Sir Tatton, and the experts showed that the signatures were forged and probably by a woman; hence the verdict was for the defendant. Now Lady Sykes must stand trial on the criminal charge of forging those notes, the proceeds of which she used in betting at horse races and in stock speculations.

The forging of checks, notes, orders, accounts, etc., is called commercial forgery. The forging of works of prose and poetry by putting the name of some known author on a work he has not written is called literary forgery. These two classes of forgery are entirely distinct, of course, and each has been practiced systematically as well as sporadically. A prominent detective once wrote an article for a popular review under the title "Forgery as a Profession." Forgery as a means of livelihood, and still more frequently as a means of gaining competence or wealth without work, has been assiduously practiced by many men. This criminal practice, again, has created a demand for experts in the detection of forgery, so that the critical examina-

tion of handwriting, paper and ink has become a profession.

The examination of literary form and vocabularies is also expert work which has been carried to a great length by the so-called higher critics. Many threatening and scurrilous letters are sent through the mails, contrary to the law, and in these cases the services of both classes of experts may be needed to determine the author of the letters.

Mr. D. T. Ames, who is an acknowledged expert on handwriting, says: "Of all the fourteen hundred millions of human beings on the earth, undoubtedly no two are identically the same in their personality, but we venture to say that there are much closer approximations in this respect than there are between the handwriting of any two persons." The handwriting of pupils under one teacher sometimes closely resembles each other, but everyone knows that the penmanship acquired at school rapidly undergoes changes for a few months after leaving school. The personality of the writer appears. The circumstances and environment of the penman, and his dominant object in writing, all play important parts in the evolution of a handwriting which soon becomes sufficiently fixed to be recognized among thousands for years after. So many muscles and nerves are exercised, even in the plainest handwriting, that it is obviously extremely improbable that two individuals should make all the motions in the same way. Indeed, it is practically impossible that any one should write his own name twice in fine lines so that one can be superposed on the other. The



MORTAR BATTERY INVENTED IN THE FIFTEENTH CENTURY BY LEONARDO DA VINCI.

existence of such a coincidence of form is always an evidence that one or both have been traced, and there can be no better circumstantial proof of forgery.

Every letter of the alphabet, wherever written, may be examined for the following characteristics: Size, shading, position relative to the horizontal line, inclination relative to the vertical line, sharpness of the curves and angles, proportion and relative position of the different parts, and elaboration or extension of the extremities. In scarcely one of these particulars can a man make two letters so much alike that they cannot be distinguished by microscopical examination. Still less can a forger, with different ink and paper, duplicate a single letter. Now, when letters are joined in words the difficulty of precise duplication without tracing or photography is vastly increased, so that no microscope is needed to distinguish the differences between the original and the copy.

Although a man may write his name a thousand times and have no two signatures alike, yet, if he writes naturally and rapidly, each will have so many characteristics in common with all the others that it is very difficult for even a skillful forger to imitate any one so perfectly that an expert cannot detect it. This is particularly true if the writing is legible and produced with a free forearm motion. Yet a forger can easily produce the same general pictorial effect, so that the paying teller of a bank, when his suspicions are not aroused, may accept it without question. Sometimes the imitation is so good that a man cannot tell his own signature from the forgery, when he knows that one of them is a forgery. In such cases the expert examiner is called in. The expert declines to make an immediate decision from the general appearance, as bankers are accustomed to do; on the contrary, he subjects every word and letter to a severe examination and

analysis which is just as scientific in its way as a chemical analysis of any compound.

Some of the principal tests applied to determine the genuineness of handwriting are these: The actual and relative slant of the letters, or the angles between their stems and the base; the constancy and accuracy with which a straight line is followed as a base; the amount of pressure used on the pen and the part of the stroke where it is applied, and the positions of the lines as a whole relative to the edges of the paper. The simplest punctuation mark under the microscope has its own individuality. It would be difficult to find two writers whose semicolons and quotation marks cannot be distinguished at a glance. The dotting of i and crossing of t afford an infinite number of relations between points and lines, and in both of these the time element and the freedom of muscular movement play important parts. Even the health and self-control of the penman, as well as the physical circumstances, show their influence on these little strokes.

Mr. William J. Kinsley, editor of The Penman's Art Journal, is another writing expert who has been employed in hundreds of cases in the United States and Canada. He says: "I firmly believe it to be an utter impossibility for one person to imitate successfully (so that the imitation cannot be determined by an expert) a page of writing of another. The person attempting the forgery should be able to accomplish the following: First, he must know all the characteristics of his own hand; second, he must be able to kill all of the characteristics in his own hand; third, he must know all of the characteristics in the hand he is imitating; fourth, he must be able to assume characteristics of the other's hand at will. These four points are insuperable obstacles, and I don't believe the forger lives who has surmounted or can surmount them."

Not only do individuals but also classes of people and nationalities have characteristic penmanship. Almost any one can tell the natural penmanship of a child from that of an adult. Men and women, the educated and the illiterate, the healthy and the sick, are likewise distinguished at a glance. Mr. Ames says the writer's nationality may also be told with considerable certainty.

Recent experiments have shown that the characteristics of writing are unchanged when the writer is hypnotized; that is to say, the hypnotized subject retains his habits of movement and consequently his natural penmanship. But when acting under suggestion, if the subject is told to write another kind of hand, or to imitate another person's signature, he will do so to the best of his ability, as he would in his normal state. When told that he cannot write on account of stiffness in his hand or because of injury to his arm, the effect of the suggestion is immediately seen in the altered and scrawling penmanship. And yet through it all individuality of penmanship is retained.

Mr. Kinsley recommends, as a signature which is most difficult to imitate, a legible writing which is produced rapidly by a forearm motion without lifting the pen from the paper. The style of signature once adopted should never be intentionally changed. Under these conditions bank tellers and others who know the signature will have no excuse for accepting a forgery. On the other hand, an illegible scrawl, such as many bank cashiers have adopted for a signature, is very easily imitated by a skillful penman. Here the general pictorial effect is what makes an impression, and it is not necessary for the forger to imitate each curve, as is the case in legible writing. As soon as all bank officers and customers realize this, the "profession" of forgery will be less profitable.

It has been said that the streets of Athens, when the city was the center of attraction of the intellectual world, resembled those of Bulgarian and Turkish towns by their narrowness and irregularity, says The London Architect. Strangers, when they first walked along them, used to be in doubt whether they could have arrived in so famous a city. Owing to the labors of the members of the German Archaeological Institute it has become certain that Athens possessed one street at least which was tolerably wide. It was laid out between the Dipylon at the wall on the northwest and the Agora, and was therefore north of the Theseion. The width of the roadway was about 10 meters, or 33 feet. As the Greeks, with all their ability, had not Macadam's shrewdness, the ancient street was made up of layers of earth, which required repairs constantly. One reason for the exceptional breadth was that originally a brook ran along one side, and when it was covered over, the additional space was allowed to increase the road.