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OUR WORKSHOPS HAVE SAVED THE ARMY.

Last summer we gave an account of the rapid manufacture of artillery that was going on in many of the Northern workshops, and remarked that the next great battle would be at least a noisy one. It has been not only noisy but awfully bloody; the losses on both sides having been surpassed in few, if any battles recorded in history. Nothing is plainer than that our army was saved from utter annihilation by our superiority in artillery. The number of guns in the army of the Potomac is stated at upward of 400, and the enemy, with all their energy in melting church and cow bells, have not been able to provide nearly as many. By means of our cannon we were able to repulse all of their attacks. The rebel officers drove their troops forward upon our batteries in the most reckless and determined manner, but our trained artillerists stood steadily to their guns, and mowed down the advancing foe in long lines, literally piling the ground with dead. The only successes which we have yet achieved have been due to our superiority in the mechanic arts.

With sadness, however, which we cannot express, we fear that the skill of our mechanics, the self-sacrifice of our people, and the devoted heroism of our troops in their efforts to save the country, will all be rendered futile by the utter incompetency which controls the war and navy departments of the Government.

MANUFACTURE OF DAMASCUS SWORDS.

In olden times the city of Damascus, in Syria, was renowned for its cutlery, and particularly for the manufacture of sword blades. The fame of these swords extended throughout Asia and most of Europe. They were so elastic that they could be bent like hoops, without breaking, while at the same time their cutting edge was as keen as that of a razor. Damascus blades possessed a wavy surface of regular bright and dark lines, and the mode of manufacturing them was kept a profound secret by the armorers of that city. Reese, in his Cyclopedia, states that they were made of a peculiar kind of steel, and it was the character of the metal, not the mode of making them, which gave them such superiority. The same idea is conveyed in the interesting article on the subject in the "New American Cyclopedia." From information which we have received on the subject—and which we shall hereafter cite—such statements do not appear to be reliable. Reese says of Damascus swords:—"About the beginning of the 14th century, Timeur Leng, on his conquest of Syria, conveyed all the celebrated manufacturers of steel from Damascus to Persia. Since that period its works in steel are little memorable. They were formerly of the highest reputation in Europe and the East. The famous sabres appear to have been constructed by a method now lost, of alternate layers, about two or three times thick, of iron and steel. They never broke, though bent in the most violent manner, and they retained the utmost power of edge, so that common iron, and even steel, would divide under their force."

The method of manufacturing Damascus blades was undoubtedly lost for centuries, but the "New American Cyclopedia" states that the Russian General, Anossoff, rediscovered the process of producing Damascus steel by smelting 11 lbs. of charcoal iron in a crucible with $\frac{1}{12}$th of graphite, $\frac{1}{32}$d part of iron scales and about $\frac{1}{24}$ths of a fusible flux such as dolomite. These substances are submitted to intense heat, in a blast furnace, for about five hours, when the scoria is scummed off, and the molten ingot of steel thus formed, is drawn under the hammer, and submitted to several heatings and hammerings. Of steel thus made, it is asserted that General Anossoff made several blades like those of Damascus, having the same dark and light wavy lines, which were produced after the blade was formed by pouring dilute sulphuric acid over it. General Anossoff died in 1851, and it is stated that his successors have not been able to produce such like swords. We do not wonder at this, for assuredly swords of the Damascus appearance, with wavy lines, cannot be made from bars of pure steel. The waving lines on such swords nearly resemble the minute and graceful shadings of the fine watered silk of which ladies' dresses are made, and they are due to the method of fabricating the blade, and also the combined metals of which it is composed. Blades resembling the old Damascus cimeters are not uncommon in this city, and they equal them in temper and elasticity. We are indebted to Mr. Herman Vasseur, No. 9 Maiden Lane, this city, sword mounter and scabbard manufacturer, for a description of these blades. They are made at Solingen, in Germany, the only establishment of the kind in the world. A faggot is first formed of alternate fine bars or wires, of iron and steel. Such a faggot is then drawn out, doubled and twisted several times, and formed into a ribbon. Two of such forged ribbons of iron and steel are then welded together, inclosing a thin blade between them of the best cutting English steel, and thus a Solingen Damascus blade is formed. The interior thin blade of English steel gives the sword a desirable and perfect cutting edge, and the combined twisted iron and steel, outside layers, impart to it peculiar toughness as well as the beautiful wavy surface for which it is also much prized. When ground and polished no wavy lines are recognized but by dipping the blade for a short period into dilute sulphuric acid, a portion of the iron on the surface is dissolved, while the carbon of the fine steel bars is unaffected, and appears in dark wavy lines contradistinguished from the white wavy surfaces of the iron bars. These blades are imported plain, and mounted in this city. Mr. Vasseur has lately mounted some of them in a splendid manner, to order, as presentation swords for several officers of our army and navy. The scabbards are made wholly of silver, and highly ornamented, while the hilts are tastefully mounted, with appropriate designs, partly cast and partly engraved. A silver scabbard is made by hammering rolled plate silver upon an iron mandrel of the proper form, and thus the plain sheath is produced. The ornaments, consisting of neat designs in silver, are cast from patterns, then trimmed and soldered to the sheath. A considerable portion of these silver scabbards are also gilt. They are certainly splendid specimens of sword mounting.

The inlaying of iron and steel with gold and silver is called Damaskeening, because this art was carried on upon a great scale when Damascus was the armory of Syria. It is executed by cutting burr grooves with a cold chisel, in the steel before it is hardened, and then hammering gold or silver wire in these grooves. This art is of great antiquity. We have read and heard it frequently stated that the superiority of Damascus swords was due to the mode of tempering them. This consisted in heating the hardened blade to a blue color, and handing it to a rider sitting on horseback, who instantly started off at a gallop, waving the blade against the cold north wind, which was required to be blowing at the time, or the operation could not be performed. We put no credence in such stories, because it is scarcely possible to temper a piece of very thin steel by waving it in the atmosphere, at a high velocity, during the coldest days in winter. The beauty and superiority of the Solingen blades must be credited chiefly to the skill of the artisans who fabricate them.

STEAM HAMMERS.

The London *Engineer* gives a description of the steam hammers in the Exhibition, from which we have condensed much of the following article:—

There are different classes of steam hammers; one has a fixed vertical cylinder with the hammer block secured on the outer end of the piston rod. The steam acting upon the piston inside of the cylinder raises it the full length of the stroke, then the steam exhausts and the hammer falls down by force of gravity upon the article to be forged. Another kind of steam hammer is quite the reverse of this. The piston in the inside of the cylinder is stationary, and is secured to a fixed rod; the cylinder forms the hammer, it is lifted by the pressure of steam, and then it falls by its own gravity. In both of these cases the hammers are single-acting, the steam being only employed to raise the piston, or the cylinder. In another class of steam hammers the steam pressure is used to act upon the hammer as it descends, thereby communicating to it a higher velocity than it could obtain by the action of gravity alone. This is a double-acting steam hammer. In the arrangement and construction of various parts of such hammers much difference exists.

A history of the progress of steam hammers will throw much light on their construction and application. Like the modern steam engine itself, they are of Scottish origin. The first that is mentioned in the history of inventions is that of James Watt, described in his fifth patent, dated April 28, 1784. In that patent he claims "applying the power of steam engines to the moving of heavy hammers for forging iron without the intervention of rotation wheels, by fixing the hammer to be so worked either directly to the piston or piston rod of the engine, or upon or to the working beam of the engine."

The next patented steam hammer was that of William Deverill, of London, in 1806. He claimed securing the hammer to the end of the piston rod, raising the piston by the steam, and then exhausting, when the hammer descended by its gravity.

Neither of these patents were ever put into practical operation. It is to James Nasmyth, of Edinburgh, that the engineering world is chiefly indebted for the introduction and practical application of the steam hammer. In 1838 he made drawings and arrangements for making a steam hammer with a stationary cylinder, and the hammer on the piston rod, but it was not until 1842 that he took out a patent. In one important feature, without which this hammer is of little value, it differed from the patents of Watt and Deverill. It provided for the lift of the hammer so as to graduate the blow. This is the steam hammer which was first introduced into the United States. The inventor of the moving cylinder steam hammer was the late John Condie, of Glasgow, who patented his improvement in October, 1846. This hammer is well known in America. The improvement simplified the construction and diminished the weight and cost of the hammer, as the weight of the cylinder is usefully applied for the hammer. A knowledge of its distinctive character was first generally communicated to our mechanics through the columns of the Scientific American, in an illustrated description of it on page 337, Vol. III. (old series). Steam is admitted through the hollow piston rod, and it may be used either as a single or double-acting hammer. In 1853 Robert Morrison, of Newcastle-upon-Tyne, patented and erected a steam hammer, for his own use, having the piston rod and piston forged in one piece, and of such a size and weight as to form the hammer. The piston rod was extended above the cylinder cover and worked through a long stuffing box, which formed a guide for it. This hammer has been used for ten years, and is as sound to-day as when first put up.

In October, 1855, Wm. Naylor, of Norwich, patented the application of gear for rendering the steam hammer double acting. This improvement has been extensively adopted in England. Robert Morrison also early applied steam on both sides of his piston, but he considers that double-acting steam hammers, while they may be useful for light forgings, should never be employed for heavy work. About 60 blows per minute are given by a single-acting gravity hammer. The tendency of double-acting hammers moving rapidly on large masses of iron, is to consolidate the skin and produce an unsound forging ; the center of a large shaft thus hammered will not be so sound as one forged with a single-acting hammer.

This is the opinion of Mr. Morrison on the action of double and single-acting steam hammers, as given in a communication to the *Engineer*. Mr. Naylor expresses quite a contrary opinion, through the same source, in favor of quick-moving double-acting hammers for all kinds of forgings. He asserts that the inside of a shaft may be forged as soundly with a 5-tun hammer moving with a high velocity as a 15-tun hammer with a low velocity. He says respecting the pressure of the steam assisting the gravity of the hammer :—"If the propelling force be three times greater in one case than the other, the velocity at the end of the stroke will be as if it had fallen through three times the distance ; and the effect of the blows will be as its initial weight (the hammer's) multiplied by the square of the velocity."

The largest steam hammer in the world, we understand, is used at the celebrated steel works of H. Krupp, in Prussia. The head alone of this hammer weighs 40 tuns, and the cylinder and framing correspond in weight. The cylinder is adjustable upon its standard so that the hammer may be raised and lowered bodily to adapt it for forging work of different degrees of thickness. The same object is attained by modes that are employed for raising and lowering the anvil block. Messrs. Imray and Copeland, of London, have patented an anvil block set in a close reservoir of water, and the block is raised or lowered like the ram of a hydraulic press by a force pump. A Belgian steam hammer with a water-bed anvil block is in the Exhibition. The shock of the blows is distributed over an extensive surface and this is claimed to be a great advantage.

THE LONDON EXHIBITION.

In America two modes of telegraphing are now chiefly used, namely the sounding system by Prof. Morse's electric magnet, and the recording system by printing messages with the combination instrument, which is a modification of the House Telegraph. In Europe a greater variety of modes are in use for telegraphing than with us. With respect to the instruments at the Great Exhibition, we condense the following from the London *Mechanics' Magazine* :—

BRITISH TELEGRAPH INSTRUMENTS.

The machines of various kinds which serve for the conversion of electric force into human language may be classified as follows, viz. :—Into needle telegraphs, whose communications are made by the oscillations of one or more magnetic needles, to the right or left, at the will of the operator, a specific number of such movements being appropriated to each letter or figure, and agreed upon as its representative to the eye of the receiver. "Dial," or "step-by-step," telegraphs, in which a pointer, like the hand of a clock, turning on its axis in the center of a circular dial is caused to indicate any desired letter inscribed around the circumference of the latter. Recording telegraphs, wherein combinations of dots and strokes, indented or otherwise marked upon ribboned paper, are made to represent each character in the alphabet. Printed telegraphs, whose signals are produced in plain printed type. And, finally, acoustic telegraphs, or electricity made vocal, on which plan correspondence is carried on by sound alone.

Of needle telegraphs (the class of instruments chiefly made use of in Great Britain), there are several exhibitors. The British and Irish Magnetic Telegraph Company show the single needle instruments of the late Edward Highton, who was the first to bring into practice the use of one line wire in connection with them, so as to obtain a result in working power equal to that of the old system of double wires and needles. Messrs. Reid Brothers exhibit the double-needle system, as used by the Electric and International Company.

Of dial telegraphs, all the specimens exhibited are exquisite pieces of workmanship. It may be doubted whether this system could be made practically available for telegraphing to any considerable distance ; but it is admirably adapted for the purpose to which it is being extensively applied by the Universal Private Telegraph Company, recently established for erecting and maintaining, at small fixed annual rentals, private lines of communication in large towns, for the use of persons desirous of having several places of business brought within speaking distance of each other. The instrument exhibited by this company is the invention of Professor Wheatstone. It consists of two distinct parts, the "communicator" for sending, and the "indicator" for receiving messages. The communicator contains a permanent horse-shoe magnet, at the poles of which are placed electro-magnetic coils. An axis, bearing a soft iron armature, and connected to wheelwork, moved by a handle external to the box, is made to revolve so as to pass rapidly over the poles of the magnet, inducing thereby currents of electricity moving alternately in opposite directions through the wire of the coils and along the conducting line to the distant indicator. Externally the communicator has on its upper surface a fixed dial divided into thirty spaces, twenty-six for the alphabet, three for punctuation, and one for zero. An inner circle marks the nine digits. A pointer in the center rotates by mechanism, and stops, at the will of the operator, opposite the letter he desires to send. Around the outside of the dial are thirty small depressible keys or buttons, one for each sign ; these being depressed in succession, will, by means of internal mechanism, each liberate one current or thirty distinct currents during an entire revolution of the hand from button to button round the dial. For every current thus transmitted, the pointer of the communicator and that of the indicator at the distant station will simultaneously advance step by step until they reach the letter opposite the depressed key or button. The indicator, resembling a small clock, has inscribed on its face the same letters and numerals as the communicator, and its hand receives its motion, synchronous with that of the latter, by means of an electro-magnetic apparatus.

The recording telegraphs, in some form or other, are the class of instruments in all but universal use everywhere, except in Great Britain. The parents of this system are Morse, of America, whose signals are dots and strokes, indented with an iron style upon paper, against and from which the style can be pressed and released at pleasure, by electro-magnetism, the paper itself being continually drawn forward in front of the style between rollers, moved by ordinary clockwork machinery ; and Bain, of England, whose signals were obtained by using the decomposing power of the current for making marks upon chemically prepared paper.

The improvement of such instruments now work more or less automatically. The automatic system of R. Allen is especially ingenious. It consists of three machines ; the punching machine is the first of these, and by this the ribbon paper to be passed through the sending machine is perforated with holes, representing dots and strokes of the Morse alphabet, at those points only where the current is required to mark on the unperforated ribbon at the receiving station ; next is the sending machine, into which the perforated paper is introduced. This machine winds up its own clockwork, whereby the paper is drawn forward, and stops of its own accord when the message is completed , and lastly, the receiving instrument at the distant station, which is also so arranged as to start its own machinery on receiving the electric impulse, and stop it when the perforated paper at the other end has passed through the sending apparatus.

Professor Wheatstone's automatic recorder is another very beautiful instrument of this class. The message to be sent has to be punched out, as in the former case ; but instead of using lines and dots for signals, as in the Morse system, the signals here are all dots, but are grouped above and below a line of smaller perforations, running horizontally along the middle of the paper ribbon. The punched out message forms a sort of jacquard pattern, which is introduced into the sending instrument, and by turning a handle it is passed through it at a uniform rate ; as each hole in the paper comes through the center of the clip which keeps it even as it passes, three springs, attached to an axis in connection with the handle, rise up, but only one of these can rise through the paper, because there will only be one perforation presented at the same time.

In printing telegraphs, the only instrument exhibited is that of Mr. Jacob Brett, which is memorable historically, being the instrument by which the first message was received through the first submarine cable.

The acoustic telegraph of Sir Charles Bright and his brother is a very interesting piece of electro-magnetic mechanism, beautifully simple and practical. It is exhibited by the British and Irish Magnetic Telegraph Company, who use it extensively on their lines. The current is set in motion by a pair of finger keys, one passing positive, the other negative currents, and so connected, that the sender does not pass the current through his own receiving apparatus, but only to that of his correspondent, who is thus able to reply instantly on the sending key being released. Two small hammers attached to the armatures of two electro-magnetic coils, perform their office in obedience to the temporary magnetism induced at will in the soft iron cores of the latter. These hammers are thus wielded by the operator hundreds of miles away, and by means of preconcerted strokes on two bells of different tone, endow with mysterious life these "airy tongues that syllable men's names ;" ringing marriage peals and knells of death, and identifying themselves with every phase of humanity.

Besides these instruments of every day use, we must not omit to notice the marine galvanometer of Professor W. Thompson, the use of which was so important in obtaining signals across the Atlantic. Its specialty, however, is for making delicate tests of long cables, especially at sea. Inside the coils, a small magnet fastened to a little circular mirror is strung on unspun silk fiber, passing through its center of gravity. Outside the coils a strong directing magnet overpower's the force of the earth's magnetism. By this arrangement, neither that force nor the motion of the ship sensibly affect the position of the suspended magnet relatively to the coils. The deflection caused by currents through the coils are shown by a spot of light reflected from the mirror on to a graduated scale. This spot remains quite steady, no matter how much the ship pitches or rolls. Most accurate measurements of electric currents can thus be made at sea in all weathers.

Portable gas is manufactured in Paris on a large scale for the supply of workshops, &c. The Company have recently published a report of their operations.