KNIVES.

In forging table knives two workmen are usually engaged, one of them controlling the piece under treatment with his one hand while with the other he does all the light work, with the aid of a small hammer, his assistant dealing only the heavier blows. In this way the end of a red hot bar of steel rapidly assumes the form of a knife blade, and is separated from the rest of the bar, leaving, however, enough material to furnish the tang of the knife, the part which is secured in the handle, though this is sometimes forged from a piece of iron welded to the steel blade. The elevated portion of the knife between the blade and tang is formed at the same time by the use of the proper mould. A second heating and hammering completes the smith's share in the work. In France, where the knife manufacture has been carried to a high degree of perfection, a method of rolling the knife blanks has recently been introduced, producing excellent results.

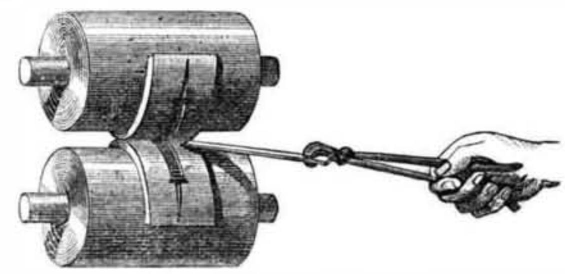


Fig. 1—ROLLING THE BLADES.

After having been properly hardened and tempered the knives pass finally into the hands of the grinders and polishers. The tangs of table knives are either flat or pyramidal in shape. The flat tangs are placed between the two halves of the handles, and are secured therein by means of several small rivets. The four-sided tapering tongues have a hole drilled for them in the hafts, and are firmly held in place by a cement composed of pitch and brick dust; in the case of knives with metal handles by pouring in molten lead.

Blades for pen and pocket knives are forged in a similar manner from small bars of steel. Their further elaboration —drilling the hole and cutting the notch along the back—is performed after a second heating. In tempering the blades after having first hardened them, they are placed upon an iron plate with their edges uppermost, and heated until they assume the right shade of color.

The accompanying illustration, Fig. 2, represents the more common form of table knife together with an ordinary clasp knife, and its separate parts. Pocket knives are composed of three principal pieces —the blade, the spring, and the haft. The haft is formed of two thin metallic plates, both covered on one side with small sheets of horn, ivory, bone, or other similar material. The blade turns about a small rivet in the upper part of the handle, and bears with its lower extremity against the spring, which is fastened at two places to the back of the handle, as shown in the engraving.

Razor making demands special care and attention on the part of the workman. A high grade of steel, a proper degree of hardness, and a very fine cutting edge are the essential requirements of such an instrument. The blades are forged from flat bars of cast steel as thick as the back of the razor, and the operation is usually carried on by two workmen upon a slightly curved anvil. They are never heated above a dull red heat, in order to prevent any deterioration in the quality of the steel, so that ten or twelve reheatings often become necessary before they are ready for their next stage, their hardening. They are heated, as in the case of the pocket knives, on an iron plate to a bright cherry red heat, and are then thrown, back foremost, into a large vat full of water, in which they are stirred about until perfectly cold. In tempering, the blades are heated in an alcohol flame or in a bath of a molten mixture of tin and lead until they acquire the proper tint of yellow, which varies a good deal with the quality of the steel employed and is only to be learnt by experience. Grinding and polishing conclude the process.

An improved method of making razor blades has lately been patented in England, consisting in stamping them from thin sheet steel and riveting two strong narrow strips upon them, in order to form the back. This process greatly facilitates the manufacture of razors, and is advantageous in more than one respect.

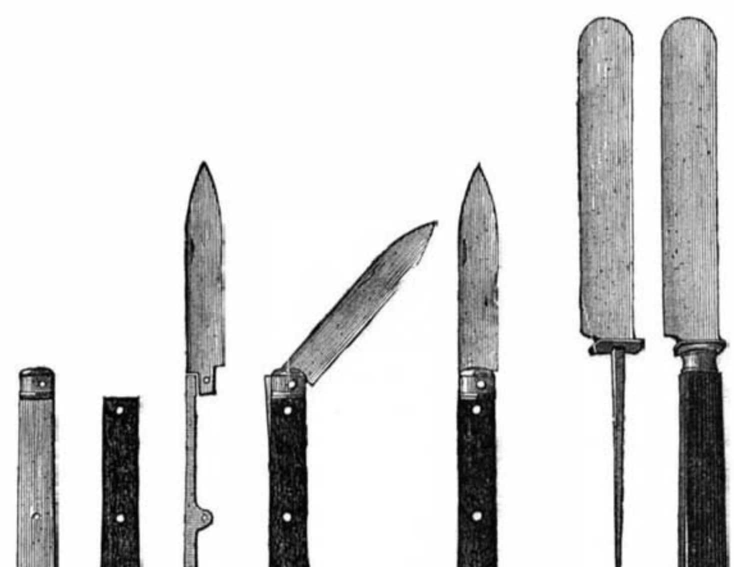


Fig. 2.—TABLE AND POCKET KNIVES TAKEN APART.

Ancient Aqueducts.

Mr. J. H. Parker, in his book on the "Aqueducts of Rome," gives us some facts which may well put modern municipalities, not to speak of governments, to the blush. The exact quantity of water daily poured into Rome in Trajan's time is known from careful estimates of Frontinus, the head Government surveyor and engineer. It amounted to 24,805 *quinaries*, a section of which amount would be just upon 120 square feet; *i.e.*, in Mr. Parker's words, "we can form some notion of the vast quantity, if we picture to ourselves a stream twenty feet wide by six deep constantly running in at a fall six times as rapid as that of the Thames." It is calculated that, when Trajan's and the Aurelian aqueducts were finished, the daily supply was quite $332\frac{1}{4}$ millions of gallons; *i.e.*, at least 332 gallons per head, for the population of old Rome probably never exceeded a million. Nowaday forty gallons per head per day are thought ample, and by many excessive; these forty including, of course, all that is used in manufactures, in street cleansing, sewer flushing, etc. The site of old Rome was notably unhealthy, and there was much over-crowding; yet after the chief aqueducts were made, no city of antiquity was so free from epidemics. Another point to which Mr. Parker calls attention is the care with which the best water (such as the Marcian, now lately brought into use again) was kept wholly for drinking purposes, while the muddier and less pure (such as the Anio Vetus and Novus) was used for street and sewer flushing, for the baths, and for scenic representations.

Steel Wire Rope.

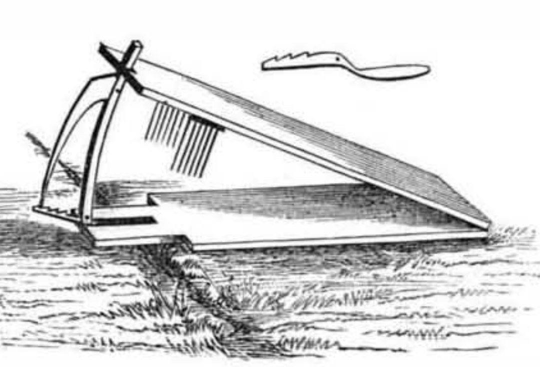
Some important trials of steel wire rope hawsers have been lately made at Portsmouth dockyard, the results being such as to astonish the operators as to the enormous tensile strength which had been imparted to the wire. Steel is not entering largely into the construction of our ships of war, but their standing rigging and hawsers are being gradually made of the same light and durable material, and in a short time we may fairly expect that the present unwieldy chain cables in use will be superseded by steel wire cables of moderate thickness and weight. The substitution of the one for the other has long been thought desirable, and after the tests at Portsmouth there can be no longer any doubt of the power of well-tempered wire strands to withstand enormous strains of ground gear. The advantages to be derived from the change are obvious and important. With a chain the safety of the ship depends upon the weakest welding, and when a single link parts, either from inherent defect or from a sudden jerk, everything parts, and the vessel drifts from her moorings. With a wire cable, however, the effect is different. Even when tested to the breaking point timely notice is given of the coming fracture. It does not snap suddenly like a chain, but first one strand, then another gives way, and it is possible for a wire rope to hold the ship even when one half the strands have exhibited signs of distests.

The recent tests at Portsmouth were of various samples of steel hawsers for towing purposes, it having been found from the experience of the Valorous and other ships that a wire hawser possesses equal flexibility to the best hempen rope, combined with less weight, superior handiness, and greater endurance, without any increase in the first cost. Official experiments at Portsmouth have also established the fact that the breaking strain of a steel hawser is more than three times that of a rope hawser. Thus a 9 inch ordinary hawser will break under a strain of $16\frac{1}{8}$ tons, and a 19 inch hawser under a strain of 72 tons, whereas Bullevant & Co.'s 3 inch steel hawser broke at 18 tons, and their 6 inch hawser at 80 tons. In the matter of weight the advantage is also clearly on the side of the steel, the 3 inch and 6 inch wire hawsers weighing 7 lbs. and 29 lbs. per fathom, while the 9 inch and 19 inch hempen hawsers weighed 19 lbs. and 84 lbs. per fathom. Up to the present time the navy has been wholly supplied with steel wire hawsers by Messrs. Bullevant & Co., of London, but the recent trials were made with four samples of steel hawsers submitted for test by Messrs. Scott Brothers, of Bishopsgate Street. Within, the wire of which was made, drawn, and twisted into rope at their works at Nutsford Vale, West Gorton, Manchester. The samples operated upon were respectively of the circumference of 3, 4, 5, and 6 inch. The core of each was formed of tarred hemp, over which was twisted 6 strands, each strand being composed of 19 highly tempered steel galvanized wires. The 3 inch hawser, which was formed of 15 gauge wire, broke at $22\frac{1}{8}$ tons; the 4 inch, 14 gauge, at $35\frac{7}{8}$ tons; the 5 inch, 12 gauge, at $57\frac{3}{8}$ tons; and the 6 inch, 10 gauge, at the enormous strain of $100\frac{3}{8}$ tons. In every instance the strands parted at the splicing, which were the only parts displacing any appreciable elongation under the tests.—*London Times.*

EXTERMINATING MOLES.

Mr. Hand, of Sing Sing, N. Y., after trying numerous devices to catch the moles, planned the one represented in the annexed engraving, and finds it very effective. It is made of two boards, an inch in thickness, 7 inches in width, and 2 feet 6 inches long, attached to one end by a broad butt hinge. The bottom board is made with a central slit to admit the free play of the trigger, which is represented in the right hand corner of the engraving; it is of iron, 10 inches long; the lower part 5 inches long, $1\frac{1}{8}$ inches wide, and the left end notched and $\frac{3}{4}$ of an inch wide perpendicularly. The post, 16 inches high, is curved to the circular sweep of the top board on its hinge. The teeth, six in number, on each side, are riveted $\frac{7}{8}$ of an inch apart, in a plate $5\frac{3}{4}$ inches long and 1 inch wide, which is fastened to the board by screws.

The trap is set, as shown in the illustration, across a mole



track, first digging a hole 8 inches square and 6 inches deep, and returning the soil, taking care to exclude all stones and large pebbles. Press the earth down pretty firmly, and set the trap so that the trigger touches the surface of the ground exactly over the line of the track. When the mole goes along his accustomed road, and finds it obstructed, his movement in re-opening the track inevitably heaves up the surface, so as to set off the trigger, and the teeth on one side or the other will catch him. Weight the trap with a heavy flat stone. In taking the mole out, dig down to him on the outside first; for if you simply raise the trap, and he is not dead, the teeth will be drawn out and he will escape, though mortally wounded.—*Country Gentleman.*

The Ribbon Fish.

Frank Buckland, in a recent letter to *Land and Water*, says: "I have received, through the kindness of a correspondent at Nice, a very interesting and remarkable specimen of a ribbon fish. I make him out to be a *regalicus*. I have never before seen one of these most curious fish in the flesh. It measures five feet, is about a quarter of an inch thick, and is of a silvery hue, not unlike the color of the 'silver-hair tail.' Upon the top of the head there are filaments, which, when stretched to their full, are about eight inches long. The head is very remarkable; altogether it is not unlike the shortened head of a horse. The mouth is prehensile, and so peculiarly formed that it is quite worthy of a figure; the eyes are very large and circular; the iris of a lustrous silver color. Behind the head the body is two inches and a half deep, in the middle two inches, at the tail a quarter of an inch. When held up to the light it is almost transparent; the vertebræ can with difficulty be seen, but with the movement of the fingers each vertebræ will give a slight crack at the junction with its neighbor. The vertebræ are longest and thickest towards the tail end, at which there are sharp spines. It is covered everywhere with a fine silvery powder, which readily comes off in the hand. It has a crest of about an inch in height, which runs down the whole of the back. The rays forming the crest are united to double pillars of very slender bone. In substance it is very delicate, and begins to dry and harden almost immediately on exposure to the air.

"I cannot find much about this fish in any of my books. This family of ribbon-shape form consists of seven genera and twenty-six species. Mr. Swainson remarks of it as follows:

"'It contains the most singular and extraordinary fishes in creation. The form of the body, when compared to fishes better known, is much like that of an eel, the length of the body being in the same proportion to the breadth; but then it is generally so much compressed that these creatures have acquired the popular name of ribbon fish, lath, or deal fish. The body, indeed, is often not thicker, except in the middle, than is a sword, and being covered with the richest silver, and of great length, the undulating motions of these fishes in the sea must be resplendent and beautiful beyond measure. But the wonders of the mighty deep are almost hidden from the eye of man. These meteoric silver-coated fishes appear to live in the greatest depths, and it is only at long intervals, and after a succession of tempests, that a solitary individual is cast upon the shore with its delicate body torn and mutilated by the elements on the rocks, so that with few exceptions they are scarcely to be regarded as edible fish.'

"According to this authority, the Mediterranean has hitherto produced the largest proportion of the family, but it is distributed from the arctic regions to the sunny shores of India, so that probably a tithe have not yet been discovered."