DAMASCUS STEEL.

Probably there are many of our readers who have never seen a genuine Damascus blade either a saber or razor, but there is quite a trade still carried on in these articles notwithstanding the common opinion that the manufacture is to be reckoned as among the lost arts. To the eye the surface of Damascus steel presents a variegated appearance, silvery and dark lines crossing each other in a sort of irregular net work. One of the finest specimens we have ever seen was a sword blade, more than three feet long, a present from a Tartar Emir to a former United States minister to St. Petersburg.

This steel is very generally imitated in appearance by English manufacturers, but their specimens do not possess the rare qualities of the genuine article. As nearly as can be ascertained the foundation of these blades was the Indian "wootz." This is smelted from a magnetic oxide, yielding, by the crude process employed, only about fifteen per cent. About a pound of the ore is placed in a clay crucible with bits of dry wood, covered by green leaves of particular plants. The crucibles are luted with clay and submitted to a blast charcoal furnace. The fire is kept at the highest possible temperature for nearly three hours, and on removing from the fire and cooling, the crucibles are broken and the steel found as a lump or button at the bottom. Selections are made from these lumps and those which are accepted are exposed again to a red heat for several hours and then drawn out under the hammer. This "wootz," or Indian steel, is considered superior for cutlery to any of the English make. It is supposed the Damascus blades were forged from this steel, which is still made in Persia as well as in Hindostan.

It has been supposed that fagoting short bars, remelting, and working them over and over, was the true secret of the superiority of the Damascus blades; but this does not seem to be sustained by experiment. Some years ago Gen. Anossoff, a Russian, made many experiments with great minuteness of detail, and finally he established works at Zlatoosk in the Ural where were mines yielding the ore he desired. His most successful process was melting the ore with graphite in crucibles in the proportion of eleven pounds of ore with five of graphite, and one thirty-second part of iron scales with a small quantity, one twenty-fourth, of flux, as dolomite or magnesium limestone. The crucible is placed in a blast furnace and kept from four to six hours.

The following are Gen. Anossoff's requisites for the best steel; Charcoal of the clearest sort, as that from pine; a furnace of the most refractory materials; the best quality of crucibles; iron very malleable and ductile; pure native graphite or that obtained by pulverizing the best crucibles; flux of dolomite or calcined quartz; a high temperature, and fusion continued as long as possible. The working after the crucible is cold is simply repeated heatings and forgings. The sword blades are tempered in hot oil. The razors made from this steel are of very superior quality, but the cost is excessive; the steel being valued at $1·10 per pound. The blades produced by Gen. Anossoff seem to be of equal value with the original Damascus blades, one of them cutting through a gauze handkerchief floating in the air, cleaving bones and even nails without injury to the edge. Gen. Anossoff died in 1851, and it is said the cutlery made at his establishment is not of so good a quality as when he personally superintended its manufacture.

The Force of Expansion by Heat.

It has been found by experiment that a bar of malleable iron of a square inch in section is stretched one ten-thousandth of its length by the pull on it of a tun-weight, and it has also been found by further experiment that a similar elongation is produced by heating the bar 16° F. Also a tun pressure on the bar, or a cooling of 16°, will produce a contraction of one ten-thousandth of its length. Thus there is established in this case an equivalence of a tun weight and a heating or cooling of 16°. The pushing or pulling of the bar by a tun weight, and the expansion or contraction by the 16° heating or cooling, each involves the same amount of force. But it will be observed that the precise figures arrived at are the results of experiments which are of necessity crude, and that as far as expansion by heat is concerned, they show it as acting only in one direction while in fact it takes place with equal force in all directions.

The whole amount of force concerned in expansion by heat may be accurately calculated in any case from Joule's equivalent. A unit of heat, or that amount of heat which will raise 1 lb. of water 1°, implies a force which will lift a weight of 772 lbs. one foot in hight. Whenever a unit of heat is wholly used in expansion, it follows of necessity that the total force of such expansion is 772 foot pounds. But as the expansion takes place only through short distances, it is necessary to reduce the expression to other terms in order to make more apparent the enormity of its force. Then 772 foot-lbs is equivalent to 9,264 lbs. raised 1 inch, and 9,264,000 lbs. raised one-thousandth of an inch. Thus if the whole force of expansion of a mass of iron which was produced by a unit of heat were exerted in one direction, it could lift a weight of 4,632 tuns to the highth of one thousandth of an inch.

Such calculations show how enormous is this silent force, and how irresistible and terrible it might be against the feeble strength of man. Yet it is so ordered in nature that it acts only a beneficent part. The gentle wind, the refreshing rain, the changes of seasons and the flow of rivers, are only a few of the many natural phenomena which are dependent upon the force of expansion by heat.

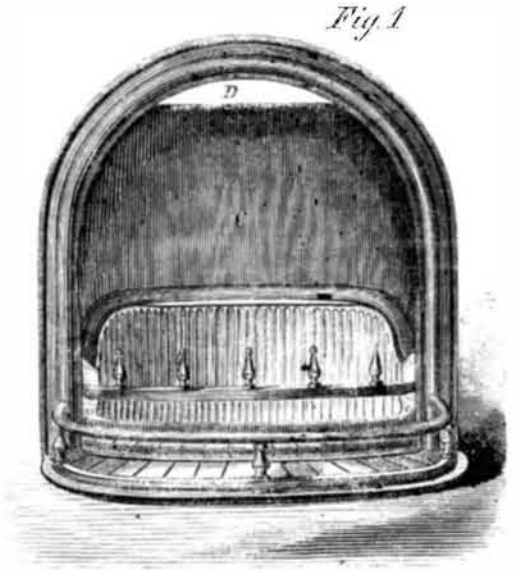
The "Cigar Ship" *Ross Winans* has recently made a successful trip in the English Channel.

DIXON'S LOW DOWN GRATE.

Those who have been brought up in the country, or city dwellers whose age enables them to remember the customs of thirty years ago, not unfrequently think with regret on the pleasures of the wide fire place with its generous glowing heat of a brilliant wood fire, or on the ample grate, which distributed the carbon prodigally and insured a perfect ventilation. With all the improvement in stoves and furnaces and the economy in fuel, we have yet to see any method of warming our living rooms so comfortable and pleasant as that of the open fire.

The engravings present two views of a grate which has been in use for many years in Philadelphia and of which a

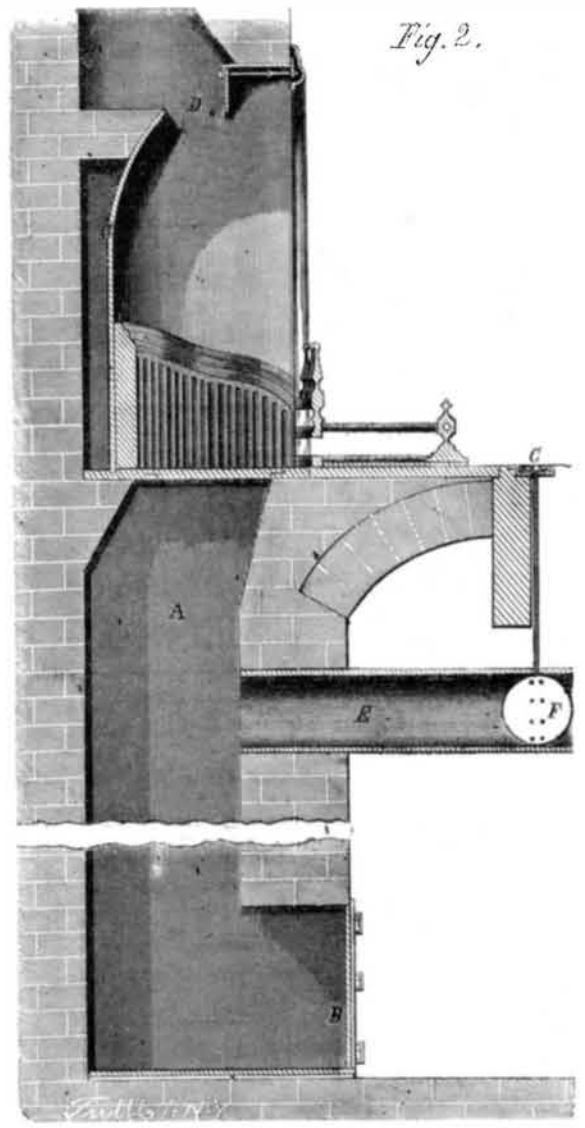
Fig. 1



number are now used in this city. Its main peculiarities are in its form, giving out a much larger proportion of the heat of combustion than others, in the fact that it does not exhaust the room of its oxygen, and that the fire is built on a level with the floor, thus warming that portion of the apartment which is always the coolest. Those who have these grates in use speak in the most unqualified terms of praise as to their action and benefits.

The fire grate is on a level with the floor, forming a portion of the hearth. This is merely a grate, the ashes falling

Fig. 2.



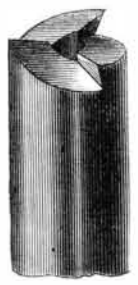
through the interstices into an ash pit, A, Fig. 2, of brick, capacious enough to hold the residuum of a season's burning, and which is finally removed through the door, B. The back, C, of the fire place, instead of being rectangular as is ordinarily the case, is concave so that the rays of heat are diverged radially to every part of the room to be heated. The heat rays are thrown downward as much as they are in horizontal *radii*, as the back is of a niche form as seen in Fig. 2, curving over to the front. This back plate is unusually high giving a great distance between the fire and the point of escape for the smoke at the throat, D, of the chimney. The ash pit for the first floor can be built of such an extent, reaching to the cellar, as to receive the products of a winter's combustion. On higher floors a more elevated fire box is used where capacious ash pits are not convenient.

The air for the purposes of combustion is not drawn from the room where the fire is situated but comes either from the cellar or from outside the house through the flue, E, the admission of air being regulated by means of a damper, F, governed by a convenient handle, G, seated in the floor. By this simple arrangement the necessity of a portable blower, which prevents for the time of its use any appreciable heat from coming into the room, is obviated, while the deterioration of the air in the room by the consumption of its oxygen is prevented thus preserving a good quality for breathing purposes and also securing a perfect circulation at all times. The throat of the chimney for the escape of gases is near the front of the fire place so that the products of combustion, traversing the curved back, must yield a large percentage of their heat before escaping.

Any additional information desired may be obtained by addressing the manufacturers, Thomas S. Dixon & Sons, 1924 Chesnut street, Philadelphia, Pa. One of the grates may be seen in the office of our neighbors G. E. & F. W. Woodward, publishers of the Horticulturist, 37 Park Row, New York city.

HANDY TO HAVE IN THE SHOP.

We present herewith the representation of the working end of a neat, cheap, and effective implement which will fill a long vacant place in the mechanic's tool chest. It is an implement intended for drawing common wood screws the heads of which have been broken. In driving home the ordinary screw the head frequently breaks, and it cannot be turned either way by the common screw driver. The same accident may occur in drawing screws which have been seated in wood for a long time, and then the wood must be cut away in order to apply a pair of pliers or similar instrument.



This tool is simply a left handed, end milling tool, cut into three radial teeth, as seen, and having a small hole drilled in the center. It has either a shank fitting a bit brace or is secured in a handle as a screw driver, and in using is turned to the left, milling off the projecting portion of the broken head until a surface is obtained, when by a few short forward and back movements three depressions are made for the teeth, and the screw is drawn as by a screw driver The small hole is for the reception of a center stud which will be formed on the screw head by the process of milling to retain the tool in position.

The engraving is enlarged from the tool left with us, but it may be made of any size to fit the screw. It is the contrivance of Lewis Garrigus, of Waterbury, Conn., who deserves the credit of presenting it to his fellow mechanics gratuitously.

Extracts from Patentees' Letters.

C. W. Royse of Petersborongh, N. H. writes under date March 27th as following:—My Letters Patent came to hand to day. Please accept my thanks for the prompt manner in which you have managed my affair. I have received several circulars from Patent Agents soliciting patronage; but be assured that any business that I may hereafter have with the Patent Office will be entrusted to your care. I shall most cheerfully recommend to my friends your Agency as the only reliable one.

Mr. F. B. Moore, of Bridesburg, Pa. under date April 1st writes as following:—My patent came all right a week or so ago. The drawings are good, specifications and claims satisfactory; in return allow me to express my thanks for the promptness and good manner in which you conducted the procurement of the Patent on my Spring Bed Bottom. I am highly pleased and will always be glad to recommend your Agency and your terms to all needing business with the patent office.

Franklin Nelson, of Wyandotte, Mich., under date of April 8, 1867, says:—"I received my Letters Patent about three weeks since, highly pleased with the correctness with which you had the instrument executed. I am fully satisfied that your facility for psocuring patents are unequalled, and it will be with pleasure that I recommend your Agency to all interested. Please accept my hearty thanks."

Steptoe, McFarlan & Co., of Cincinnati, Ohio, who avail themselves of our advertising columns somewhat extensively, add the following P. S. at the end of a business letter: "We find no other medium equal to the Scientific American."

The American Hog-tamer.

Mr. Reuben Hurd, of Morrison, Ill., is the inventor of a nipping instrument to cut hog snouts, to prevent the animals from rooting. The inventor issues a neatly printed circular concerning the improvement, which bears a well executed vignette consisting of his own portrait. It is a standing figure of a good looking individual, somewhat advanced in life, holding in the left hand one of the patent hog-nippers. Opposite the picture, printed in bold italics, is the following motto: "My invention will live on, and after I am dead will still live, until every farmer shall know that I have not lived in vain."

Gopher Trap.—John Grable, of Wathena, Kansas, says his garden vegetables and fruit trees have nearly been devoured by gophers. He has been fighting his enemy for eight years with poison, traps, cats, and dogs, with such poor success that he is almost discouraged, and now appeals to inventors for assistance. He offers a hint which he considers valuable, and thus quaintly expresses it:—"A double-geared subterranean gopher trap so constructed as to catch the gopher both ways in passing through his galleries."