THE MANUFACTURE OF AXES.

In the early part of our present volume we published an account of the manufacture of axes at the Collinsville Works, by the peculiar machinery and processes belonging to that establishment; the following is a description of the more common and general methods of manufacturing such tools. The readers of the SCIENTIFIC AMERICAN who have never been through an ax factory will doubtless be interested in this description of the manipulations through which the metal passes from the raw material until it is converted into those instruments by which the forest is made to bow beneath the woodman's sturdy strokes.

In technical language the ax is simply called a cutting tool, and indeed there is no appearance of complication about it. One with a talent for rapid description and contempt for details would describe it to be a wedge-shaped lump of iron with a steel cutting-edge, and a hole to admit a handle. This, however, gives us but a very rough idea of an ax; and a "chopper" would both sneer and laugh at the description. It is true, if not touching, that many choppers think of and cherish their axes as though these were so many children, or precious talismans. We are not sure that choppers could not be found who swear by their axes, and take them regularly to bed as a *vade mecum*. This will not appear so absurd when we learn that the ax has been made half human by the gift of a "head," an "eye," "cheeks," in one stage of its manufacture, "lips," a "throat," and a sharp, tongue-like member called a "bit."

In the best shops for the manufacture of axes, machinery is made to perform the greater part of the labor, and the workmen have little more to do than to guide the different operations. There are but few such manufactories in this country. Axes are often made entirely by hand, as it is called, that is without the aid of machinery. They cannot be made in this way, however, without great labor and little profit. The largest class of manufactories embraces those in which these two systems are combined, machinery performing the heavier work, and the lighter portions being done by hand. A factory of this kind will be had in view in the description which will shortly ensue.

THE MATERIAL OR "STOCK."

Ax-makers exercise great care in the selection of their stock. Iron that is not soft, pure, and easily welded, will make but indifferent axes. Steel that is but partially converted (from iron), or is flawy, brittle, or coarse-grained, is equally valueless. This will seem probable when we remember the constant and severe strain to which an ax is subjected while in use, and that the cutting-edge is constantly retreating towards the "roots" of the steel, from repeated sharpenings and wearing away, thus severely testing every part of it.

The best iron is brought from Russia, and is called "Old Sables." This is the most expensive of the varieties in common use, and its high price confines its employment mostly to the manufacture of the finer kind of tools. The "Swedes" iron ranks next, and is the one most generally employed. Every shade of quality may be found in Swedes iron. Very good iron, for some purposes, is made in the northern part of the State of New York. It has been successfully used in the manufacture of axes. "Ax bars" are about three inches in width, by 5-16 of an inch in thickness, and will average 12 feet in length.

The steel now almost universally used in this and other manufactures, is called cast-steel, from its being, in the process of conversion from iron, melted and cast into ingots, which are afterwards drawn out into bars under the trip-hammer. It is thought, by most, to be superior to the steel formerly used, called English blistered steel, from the manufactured bars being covered with hollow swellings resembling blisters; but still some workers of steel prefer the latter. The most celebrated makers of cast-steel are Sanderson, Bros. & Co., Naylor & Co., and Jessup & Sons, all of Sheffield, England. A newly invented process for making cast-steel was three or four years ago described in the SCIENTIFIC AMERICAN. It is thought to be of some value, but it is feared there can be no certainty of anything like uniformity in the quality of the steel made by this process. If the invention should prove entirely successful, it will have the effect to greatly cheapen the article, the costliness of which has always borne heavily on the consumer.

The bars of steel used for axes are usually one and a quarter inches in width, and ⅝ of an inch in thickness. They are imported in cases of 500 and 1,000 pounds; the bars in the larger cases being 10 or 12 feet in length, and in the smaller, from 6 to 8 feet.

THE SHOP, WORKMEN AND TOOLS.

The forging-shop has usually the solid ground for a floor. and when everything is in full blast, it affords a tolerable idea of the infernal regions. To a stranger, the roaring flames, the half-naked men, straining every muscle and perspiring in torrents, the dark recesses of the space now lit up by a sudden glare and now relapsing into their original gloom, the sparks and streams of fire flying angrily in every direction, the horrid and infernal din, the clangor of tools, and the great hammers falling with tireless, thundering energy, present together a spectacle that seems hardly earthly. No one could easily forget his first experience of such a scene.

In the forging part of the manufacture, two workmen are employed at each fire or forge; the foreman, who directs, using a small hammer, called a "hand-hammer," and the "helper" or "striker," who tends the fire and wields a large, two-handed sledge, weighing from 12 to 15 pounds. They stand on opposite sides of the anvil. The "fire" consists of a frame of cast-iron, supporting an oblong box of the same material, three or four feet in length, lined with fire-bricks, and capped over with a cast-iron lid (also lined with bricks), the blast for the fire coming up from an air-chest beneath, into which it is driven by a fan-bellows, worked by machinery. Several of these fires are distributed around the forging-room, occupying such positions as are convenient in respect to light, &c.

The foreman has ranged at hand several pairs of tongs, proportioned in size and capacity to those portions of iron or steel which they are intended to seize. The Hercules of the ax-factory—the great and never-tiring wonder-worker—is the trip-hammer. This formidable engine consists of a head of iron weighing from 30 to 60 pounds, fitted to one end of a horizontal beam, which is suspended towards the other end in a framework of solid timber, and, by means of machinery, made to play up and down, rapidly or slowly, at the will of the workmen. The head or hammer strikes upon an anvil beneath, both anvil and hammer being grooved to admit the insertion of pieces of hardened steel, called "swedges," so fashioned on their inner surfaces that when they are driven forcibly together, the lump of heated iron or steel between them must take a determinate shape. Several sets or pairs of these swedges are used in the manufacture of axes. A very useful little tool, used in cutting, is called the "hardy," a wedge-shaped piece of hardened steel, fitted to stand upon the forging-anvil, with its cutting-edge uppermost. Variously-shaped "cold chisels" are also used for the same purpose, and are furnished with handles, that they may be held by the foreman and struck by the "helper." They are tempered for cutting iron or steel, either hot or cold, from which latter use they take their name. In fashioning the eye of an ax, various "eye-pins," or wedges of hardened steel, are used. They are driven into or through the eye, and keep it in shape while the "cheeks" are being hammered to the proper shape and thinness. These are the principal tools used in the forging of axes. A number of others are occasionally employed.

[To be continued.]

HYDRAULIC AND STEAM CRANES.

MESSRS. EDITORS:—In No. 7 of the "new series," page 100, of the SCIENTIFIC AMERICAN, I find an article on the steam crane invented by R. Morrison, of Newcastle-on-Tyne, England, in which a comparison is made between his crane worked by steam and one worked by hydraulic pressure, giving the steam crane a wonderful superiority in point of economy as compared with the hydraulic one.

Having under my charge two cranes worked by hydraulic pressure, I am in a position to be able to say something in connection with their operation and expense. These are the only ones of their kind in North America. The water acts upon them in nearly the same manner as the steam on Morrison's crane, and, for utility, economy and dispatch, I believe, they stand unrivaled. The mode of operation is as follows: To a steam-engine of 16 horse-power is attached a pair of six-inch lifting-pumps, which raise the water from the harbor into a reservoir in the engine-house, whence it flows into six pressure pumps, which force the water into an accumulator, where it receives a pressure of about 700 pounds on the square inch. From the accumulator, the water is conveyed through pipes the whole length of the dock (about 1,500 feet), and, at intervals, are branches to connect with the several cranes (two only of which are at present erected), which are capable of lifting 2,350 pounds at each lift; but the engine, using steam at a pressure of 35 pounds, is able to keep 10 such cranes in full work.

I find that 1,545 cubic inches, or nearly 6¾ gallons, of water at the above pressure are sufficient to raise 2,350 pounds from the hold of a vessel, and deposit it in a railroad car 50 feet distant, or *vice versa*, the time occupied in each revolution being one and a half minutes. One man with two levers (one for raising and lowering, the other for turning) can do the whole with the greatest ease imaginable. The amount of fuel used in working one crane one day is only three-fourths of a cord of wood, costing $1.50, or 15 cents per hour; and I have no doubt that, in using a number of cranes, the cost would be considerably less per crane.

B. H. W.

Port Dalhousie, C. W., Oct. 13, 1859.

GOLD AMALGAMATORS.

MESSRS. EDITORS:—The proper materials of which gold amalgamators should be made is a matter of no small consequence to the miners of every auriferous region in our country. Various materials have been tried, and as iron is more durable than wood, and is not subject to be acted upon by mercury, it has been adopted in many cases; but thus far with unfavorable results. When new iron amalgamators that are kept moving with such a speed as to keep the pulverized ore from deposition answer very well, because their rough surfaces tend to keep the auriferous particles in a state of suspension; yet, at the same time, these rough surfaces of the metal also tend to subdivide the mercury so very minutely as to render it what the miners call "floured," which, in that state, is liable to run off at considerable loss.

Gold amalgamators should be made of wood. It is the best material for this purpose. The water slightly softens its surface, and the friction of the same renders it uneven, and of course exposes a greater extent of area to the amalgamating action. The surface of the wood never divides the mercury so minutely as to cause it to flow off; and while it thus prevents loss, it is also most efficient in producing the last results. This, at least, has been my experience for the past seven years which I have devoted to the business. * * *

Pioneer Mills, N. C., Oct. 17, 1859.

STREET-SWEEPING BY MACHINES.—The Street Inspector of our city has contracted with R. W. Smith, inventor of the sweeping-machines, to sweep Broadway at $37 per night, from the Battery to Fourteenth-street, and numerous streets named in the contract at $4 to $30, according to their length, at a total expense of about $2,000 per week. The annual expense of street-cleaning under this contract will be about $100,000. Heretofore the total expense has been about $400,000, which leaves about $300,000 to be expended in cleaning streets not named in the contract. We have no doubt but the sweeping-machines will do the work much better than has been done by hand. Great opposition has been exhibited by interested parties to keep the machines from being used. The principal objection seems to be that these machines are not able to *vote*, and have no controlling influence over the ballot-box.

STEAM VERSUS HORSE-POWER.—The subject of steam culture is now attracting the attention of the agricultural world to a large extent, having within a year or two past awakened increased interest, in consequence of the partial success which has attended the efforts to apply steam to plowing, both in England and in our own country. The subject is certainly one of the highest importance to our agriculture at large. Of the superiority ing steam for all the purposes of threshing, grinding, and its fodder, roots, &c., there can scarce be a ques has one hundred acres to cultivate, is not fairly demonstrated that careful experiment, it can se or human power. very general adoption by every farmer, provided, upon it is more economical