HOW AXES ARE MADE.

In order to withstand the severe usage to which they are put, axes are almost always made from superior qualities of metal. The bit or cutting edge is usually of the best English steel, while the head is formed from the better grades of iron.

If our reader will now imagine himself to be with us in our late visit to one of the largest ax manufactories in the country, that of Messrs. Weed, Becker & Co, in Cohoes, N. Y., we will endeavor to lead him through the many workshops of the establishment, and thus trace the making of the ax from its first reception in the shape of bar iron and steel to its final packing in finished form, and its shipping to the trade.

The iron portion of the head is cast in a mold, but its shape is far from resembling that which it will attain when finished. The eye, in which the handle is inserted, is there, but instead of the metal tapering off to an edge it is formed in two branches, so that the casting is in fact an ax, split from its edge to the eye. As we enter the foundery, a large number of these rough pieces are being removed from the flasks; beside them lie the pieces of steel which are to form the edges, so that the process we are about to witness is the welding together of these two portions and the first shaping of the tool. A smith seizes one of the iron castings with his pinchers, heats it in his fire, and, holding it under a powerful trip hammer, welds the separated edges together. He then passes it to another workman, who again heats the piece to redness and then fits to the edge the bit or piece of steel, in the side of which a groove is cut. Another heating takes place, more hammering with the trip hammer and by hand, and the shape is complete, both steel and iron being firmly welded together. The edge is now rounded, smoothed, and flattened, and the ax is placed under a swage die from which it receives its peculiar rounded or convex form. This is all termed the "cutting process" and, as nothing more can be seen in this workshop except perhaps the different manipulations necessary to form the axes of varied shapes, we pass to another smithy where the holes or eyes for the handles, which the previous hammering has nearly closed, are opened and made into proper shape, and where the head or butt end of the ax is hammered square and even. This is done by heating and pressing on flat stones, so that, when finished, the tool is perfectly true and square at all its angles.

We next pass to a room containing several large grindstones, which, kept constantly wet, are in rapid revolution. Here the ax is smoothed and the roughness and scale on its surface removed by pressing against the stones. This completed, we follow the tool to the temperer. Each workman stands before a small coal fire, which is contained in a very narrow though long grate. Above the hot coals are bars on which the axes rest while being heated. Taking each tool separately, the temperer heats it to redness, and then suddenly plunges it into a pickle of brine and then into a tub of cool water, to wash off the salt which adheres. In this condition the ax is intensely hard; the metal is crystallized and brittle, so that it would probably snap in pieces at the first blow. It is necessary, therefore, to "draw" this temper, and the process is one involving considerable skill on the part of the operative. The ax is again placed over the coals, and as we watch it we notice its color change from white to straw color, and finally to what is termed "pigeon blue," when it is suddenly plunged in the cold water, and the tempering is complete.

The ax is now ready to be ground, and in order to witness the process, we pass through a dense cloud of dust into the grinding room. Here are forty immense grindstones driven at a fearful rate of speed. Above each stone is the saddle or piece of wood, one end of which is fastened to the frame of the grindstone, while the other is held up by a strap suspended from the roof. Across this saddle sits the grinder, who inserts the ax under the end or pommel of the saddle and bears it down with his whole weight against the stone. The labor requires considerable practice and no small degree of skill, as it is absolutely necessary that every tool should be ground perfectly even at all portions. The men engaged at this work were mostly French Canadians. We were informed that all were more or less unhealthy, and that it is common for them to die of consumption after a few years' labor as grinders. The air is filled with particles of metal and grit which they constantly inhale; this irritates the lungs and eventually causes acute disease. Polishing is the next process, and is performed on wheels covered with emery and oil. Each ax, after having gone through this operation, shines like polished silver. Inspection of the most rigid kind follows. We find a workman sitting before a small anvil, taking up the axes, one at a time, and tapping them with his hammer. Nothing passes his observation. An ax, which appears to us perfectly sound at every point, rests on his anvil. A blow or two with the hammer and his quick ear detects a difference in sound. Picking up the axe, he dashes it against the anvil, away flies a corner of its edge, proving that the temper was unequal. Another is thrown aside for a minute, almost imperceptible, crack. A third yields too readily to the file; and thus the inspection goes on, the rejected tools being, if possible, made over, or else finding their way to the scrap heap.

Now comes the painting and labeling. Passing into another apartment, we find hundreds of finished axes hanging on frames. Some are red, others black, others bronzed, in order to suit the varied tastes of the market. From a room below, we hear the whirr of lathes, and looking down, we see the great logs of hickory rapidly cut up and then placed in machines nearly resembling the lathes used for making shoe lasts; and we thus see the finished handles turned out with incredible rapidity.

Meanwhile, around us, men are engaged in branding and boxing the finished tools. Here are axes, hatchets, adzes, mattocks, turpentine tools for North Carolina, and hammers of every description. Huge Spanish axes destined for the hands of the Indians of South America to hew their way through the forests of Peru and Equador, odd shaped hatchets for the hunters and the bush rangers, marked for Australia, and dozens and dozens of other tools, all painted, labeled, and ranged in their cases, are strewn around, ready for distribution throughout the whole civilized world.

The works, our inspection of which concludes in the last mentioned apartment, cover a area of five acres of ground, and furnish employment for 250 workmen. About 150 dozen of axes and other tools are daily produced, at a yearly valuation of over $400,000.

THE CAR SHOPS OF WEST ALBANY.

The New York Central and Hudson River car shops are substantial brick buildings, covering an area of about 60 acres of ground, situated about two and a half miles from the city of Albany. The different shops range from three to five hundred feet in length. The main power of the works is derived from a centrally located building containing two low pressure engines of 200 and 125 horse power respectively. Steam is supplied by four steam boilers. An auxiliary engine of 75 horse power is located near the machine shop The works are divided into two portions, one devoted to the construction and repair of locomotives and the other to the fitting up and building of cars. The locomotive department, under the superintendence of Master Mechanic G. B. Van Vorst, is an immense building 500 feet in length. Six hundred hands are here employed, four hundred and eighteen working in the shops, the balance being engineers and firemen. The work done is principally repairing, although locomotives are occasionally built. At the present time, two engines are in process of construction for the Central branch of the road.

The foundery, forge and hammer shops attached to this department manufacture nearly all the castings required on the line, besides a large proportion of the axles and general heavy forgings. Fifty switches are now being made to be located near Syracuse in this State. The round house is one of the largest in the country, being 278 feet in diameter, and containing 41 stalls. In the oil house adjoining, is a tank holding 115 barrels of oil.

The car shops proper are superintended by Mr. Joseph Jones, Master Car Builder. Few new cars are here constructed, the work being principally the alteration and repairing of those already in use. We noticed some old cars being fitted with the Miller platform, and our attention was directed to some 40 cars designed for the transportation of horses. These are 29 feet long by 8 feet wide, and are six inches higher than the ordinary cattle cars. The sides are sealed to within 18 inches of the top, the remaining space being slotted, so that ample ventilation is secured. A hundred new combined coal and platform cars are also being built, 29 feet length by 8 feet width being their dimensions. They are fitted in the center of their flooring with dump doors worked by iron shafts.

The blacksmith shop is a model in its way. It contains fourteen octagonal chimneys, arranged around each one of which are four fires. The building is remarkably light, airy, and spacious, and is fitted with every possible convenience and improvement.

The paint shop, which was formerly a large building capable of containing thirty cars, is now a heap of ruins, having been burned to the ground. The estimated loss by this fire is over $120,000. The plans of a new edifice to replace the lost one are already finished, and the work will shortly be commenced. The building will be 130 feet wide by 700 long, and it will accommodate 88 cars.

The storage building contains, besides a large variety of fittings, etc., a machine for cleaning old car cushions after they have become filled with dust and dirt. A large lumber yard filled with timber of every description supplies the wood working portion of the shops with material. Fire is provided against by a powerful steam fire engine and a donkey engine rigged on the top of a locomotive, the apparatus being kept constantly ready for use. A wrecking car is also kept in condition for immediate service. It is 48 feet long and contains all the necessary tools, derricks, etc., for making repairs or clearing away wrecks.

The traverse table, used for transporting cars from track to track, is a device recently introduced in the works and is one of the best pieces of mechanism in the establishment. It is the invention of Master Car Builder Jones, and its working has proved in every way successful.

An excellent feature of this establishment is the provision made for the rewarding of the most deserving of the workmen by furnishing to them commodious and admirably fitted-up cottages at a merely nominal rent. Sixty of these dwellings are now built, each 22 by 32 feet in size and containing ten finished rooms beside all conveniences. The rent is from eight to ten dollars a month, a sum barely sufficient to cover the interest of the sums laid out on their erection. A boarding house is also provided, where thirty-five men are accommodated at a very moderate price.

The Manufacture of Vinegar.

A. H. R. sends us a letter in which his troubles, labors, and expenditure as a manufacturer of vinegar are fully detailed. He certainly has gone to work in a liberal manner, as the following passage from his letter will show:

"I have been in the vinegar business for two and a half years, using in the process no acids, but cider, high wines, and occasionally malt and cider. In one building I have eleven tanks, each of 800 gallons capacity; this structure is on a sand bottom, and is floored with planks fastened to cross pieces bedded even with the sand. The walls are of stone up to the second story, and there is a hill behind the building, as high as the roof. The tanks abovementioned are of clear white pine, and were new last fall. A stove to prevent freezing was put up, and the contents of only one of the tanks was, last winter, affected by frost. The door of the building has been kept well caulked up to ensure an even temperature. Adjoining this building is a three story frame structure, having eight tanks of 1,000 gallons capacity each, on the ground floor. These tanks are filled with vinegar or cider, and are kept warm by the exhaust of our pumping engine. At this season, the average temperature on this floor is from 75° to 90°, and in winter it ranges from 50° to 60°. Going from it into the first described chamber is like stepping into an ice house.

I commenced by making strong vinegar, showing 18° or 20° (Baumé, probably. EDS) when first made. One gallon of sirup was added to each 80 gallons of cider, and the whole fermented, settled, and run through generators 25 feet in hight, newly constructed and filled with shavings of red beech. A few days ago, the vinegar began to lose its strength, and to preserve it, I gave it more body, which only served to arrest the deterioration, and now it is all spoilt, and I find myself with only one tank of good vinegar, having this week allowed 2,000 gallons to run to waste. The generators are still running, and seem to work well.

The cold damp air has killed the vinegar and the trouble spreads from one vat to another, like an epidemic; and nevertheless, the acidity remains unimpaired. Have you or any of your readers had similar experiences? If so, perhaps my case may be a warning to them, for my loss is a very serious one. My father tells me of a similar occurrence four or five years ago, and it was then attributed to the poverty of the cider, or to something added to it to keep it sweet. Any light you can throw on the difficulty will be thankfully received."

We give our views in another column.

How Gypsum Acts on Soils.

The exact way in which gypsum produces its fertilizing effects is not well understood, although it is known that the chemical changes or transformations which occur when it is brought in contact with soils are not of a uniform or fixed character. Upon the conditions which exist as regards the presence of vegetable matter and moisture, depend the changes that take place.

It has been proved by actual experiment that gypsum is capable of absorbing ammonia from the air, and also from decomposing animal or vegetable matter, in the form of sulphide of ammonium. This again may be changed into carbonate of ammonia, by absorption of carbonic acid from the air. These changes take place when gypsum is brought in contact with moisture and vegetable matter.

Whatever other decomposition may take place under different circumstances, this must be regarded as the most important, as from it plants are supplied with food of the highest value.

From this ascertained fact, it may be inferred that plaster must prove highly serviceable to moist, mossy hills, and also to meadows which are not too wet. Experiment has shown that the north side of a hill is sometimes greatly benefited by plaster, while upon the southern exposure it produced no perceptible effect.

It is certain that it does not matter much what may be the nature of the soil to which plaster is applied, since it is external agencies which are principally concerned in fitting it for plant food.

While the question as to how plaster acts as a fertilizer cannot be regarded as by any means settled, yet there are certain facts to guide its application. It would be manifestly absurd for a farmer to apply gypsum to a dry, silicious plain, or to a not impoverished slope; and also it would be unwise to use it upon a meadow under water some months in the year.

Plaster may be applied with confidence to pastures and fields which are strong enough and moist enough to support deciduous trees. A hill side where moss will grow so as to crowd out good grasses is usually promptly benefited by plaster, and the white clover comes in at once.

Artificial Hatching of the Sturgeon.

It seems that the sterlet (*acipenser ruthenus*), the smallest of the Russian sturgeons, spawns in the Volga early in May on rocky bottoms, the temperature of the water being at 10° R. (54½° Fah.). The eggs are readily fecundated by the artificial method. After they have been in the water a few minutes, they adhere to any object which they touch. The development of the embryo can be observed in progress at the end of one hour. On the seventh day they hatch. At first the young fish are about $\frac{2.7}{100}$ of an inch long. At the age of ten weeks, they are nearly two inches long. They feed on larvæ of insects, taking them from the bottom. Both in the egg and when newly hatched, the sterlet has been taken a five days' journey from the Volga to Western Russia, and in 1870 a lot of the eggs were carried to England to stock the river Leith. This species passes its whole life in fresh water

Colored Spectacles.

Dr. Stearns writes: "The photographer uses orange colored glass to exclude the actinic rays of light, and why some optician has not had the genius to see that orange is the proper color for spectacles, instead of green or blue, for persons with weak eyes is beyond my comprehension. A room in the hospital with which I am connected is lighted through orange colored windows, and is used by patients who have certain diseases of the eyes requiring the exclusion of the actinic rays of light. It has been very satisfactory. Orange is also, I believe, the proper color for bottles containing chemicals affected by light."