

WELDING AND FORGING STEEL.

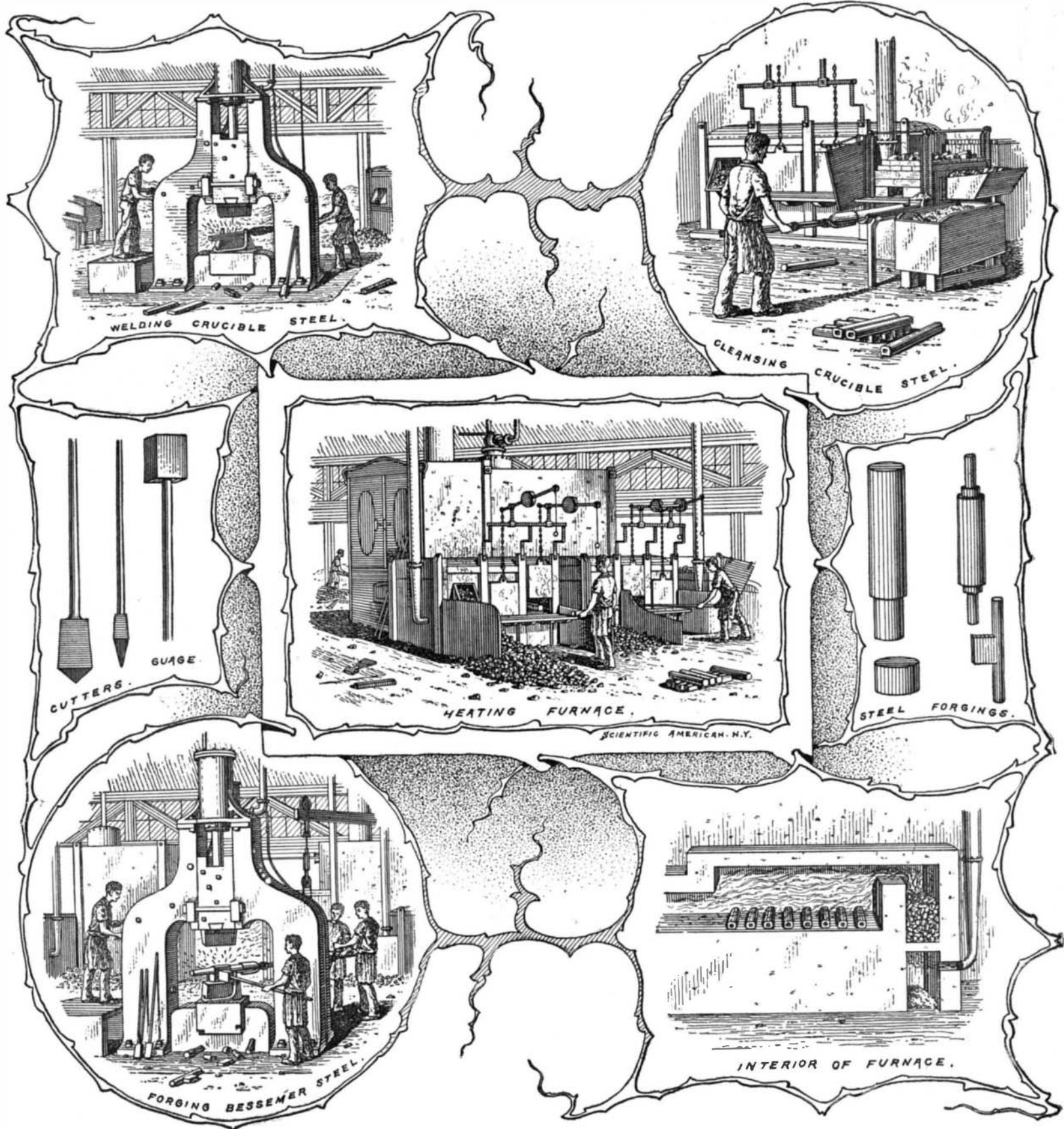
The illustrations accompanying this subject were taken from the plant of the Benjamin Atha and Illingworth Company, Harrison, N. J. Crucible or tool steel is used principally for manufacturing tools requiring strength and elasticity, such as agricultural implements, machinist tools, etc. Certain grades of steel are first melted up and run into billets weighing about 75 pounds each. They are about 24 inches in length and about 3½ inches in height and width. The billets or ingots to the number of eight are placed in a furnace about 3 or 4 inches apart and left to heat about a half hour. The interior of the furnace is about 6 × 8 feet in length and width, and is about 2 feet in height and lined with fire brick. Soft coal is used for heating, the flames of which are blown through and

heated for about ten minutes, bringing the color up to a bright red.

They are then taken out one at a time and placed into a retort heated by a coke fire for about two minutes. The interior of the retort is about twelve inches in width, about twelve inches in height and about four feet in length. They are then drawn out and the scale scraped off by the operator drawing the ingot back and forth across the sharp edge of the iron shelf in front of the mouth of the retort. The ingot is then drawn back and forth into a trough filled with a composition of plaster of Paris and borax, the red hot billet causing the composition to melt and enter the cracks and seams, cleaning out the dirt and grit. The billet is then placed on the steel die of the welding apparatus and hammered down into a perfect solid bar,

hammer. The apparatus for forging is similar in shape to the welding machine. The hammer or slide is about two feet in width, about three feet in length and about one foot in thickness.

The striking part of the hammer is made of steel, and is locked securely to the bottom of the ram or slide. The striking and stationary die each weigh about 225 lb. They are about 18 inches in length, about 8 inches in width, and about 8 inches in height, both being placed in an oblique position. The cylinder is about 4 feet in length and about 18 inches in diameter. The hammer makes a 2 foot 8 inch stroke, and is worked by means of levers in the same manner as the welding machine, about 60 to 70 lb. of steam being used to run the apparatus. As soon as the bar has been heated up to the right color it is taken out



THE TOOL STEEL INDUSTRY.

across the billets by means of a blast pipe connected to the sides of the furnace, the air passing up underneath and through the fire box. After the material has been heated to a cherry red color, it is taken out and hammered down so as to fit certain sized tongs. The jaws or clasping end of the tongs are scoop-shaped, fitting around and holding the ends of the billets securely when being hammered. The welding hammer is worked by steam and weighs about 3,500 pounds. The hammer is raised and lowered by means of an upright steam cylinder connected to the top of the machine, the piston rod of which connects with the top of the hammer. The hammer makes a stroke of about 2 feet 8 inches. The operator who regulates the stroke of the hammer by means of levers can give the billet a light or a heavy blow, the light blow being given by means of a shut-off lever. After the first heating, the ingots are placed in another furnace and

the right shape and thickness for the rolling mill, which in turn presses it out into round, square or flat bars of steel. If the billets are left in the furnace too long, they will break into small pieces as soon as the hammer touches them. Three hands can weld nine heats of eight bars each daily. Forgings are made of soft Bessemer steel. They consist principally of piston rods, shafting, pinion blocks, eccentric cranks, connecting rods, planer heads, cranks, different parts of engines, etc. They are forged out in a rough state and sent to machine to be turned down into the proper shapes and sizes. The soft steel comes in the form of billets and is first heated and beaten out flat or square, according to the size of the forging wanted, with a steam hammer weighing about from three to five tons. The bars of steel are then sent to be forged into shape. They are first heated in a fire brick furnace to a bright red heat and then placed under the

by means of a pair of tongs and a derrick, and placed in position under the hammer. To forge it down to the right width and thickness an attendant places a squaring tool or gage against the bar, holding it in place until the hammer strikes it. For cutting into the heated steel where a section is to be rounded off a V tool is used, the cut being made by dropping the hammer on the tool. The section is then rounded off by the operators turning the bar slowly around and tapping the metal with heavy and light strokes of the hammer. Four hands are required at the forging hammer, two for turning the metal on the die, one for cutting and gaging, and one for operating the hammer. Some forgings weigh as high as 2,800 lb.

THE authorities of Boston University have decided that the students must either give up the use of tobacco or leave the institution.

Another Large Telescope.

At the modest shop of the Clarks in Cambridge, Mass., the lenses of the great forty inch telescope for the Yerkes Observatory of the University of Chicago lie practically finished, and await only the final tests of the committee of inspection for their acceptance. These will probably be made in two or three weeks. The mounting of the telescope, however, will probably not be completed until spring, for the construction and equipment of so large an instrument is really a matter requiring much time. So far as the lenses are concerned, Mr. Clark considers them superior in definition and figure to any of the comparable glasses which have been made by the firm.

The largest work now in hand here is the new Percival Lowell telescope. It will be remembered that on his return from Arizona, Mr. Lowell was so well pleased with the results obtained that he at once expressed an intention to observe Mars during the opposition of 1896 with a large telescope and from the very best site discoverable. He at once ordered a telescope from the Clarks and sent an astronomer around the world to select the place for the observatory.

The telescope is to be of twenty-four inches aperture, a truly large glass, even as compared with the monsters which modern opticians have been able to construct, and an order was at once placed with Mantois, of Paris, for the disks of glass, which were to have been delivered early in August. They are now here a month late, and this lateness means a little more expedition on the part of the lens shapers, since the completed telescope must be ready for Mr. Lowell at a given date in June of next year. An examination of the plates of glass shows them to be of the finest quality, and in the opinion of the experts in the shop in Cambridge have never been excelled by any of the disks which have been received there.

The flint glass has already received its rough grinding and takes on something of the shape which it will have when completed, but there are many refinements and very large requirements in point of time and attention before it can even be tested as a lens, beyond which time there are all the necessities of delicate final correction. In the forming of these lenses some departures will be made from the regular methods which have heretofore been employed, notable among which will be the substitution of glass forms for the metal ones which have been customarily in use for the earlier processes.

For this telescope the Clarks are themselves constructing the mountings which, aside from the pier, will weigh some tons. The material for the pier will depend in some measure upon the site selected, for if this should be in some desert, where stone is not available, a steel pier will be taken from Cambridge. The question of site is still undetermined, reports in the newspapers to the contrary notwithstanding, and Mr. Douglass is still abroad in search of a perfect atmosphere.

Trees and Insects in Central America.

In Mr. Richard Harding Davis' account of the travels of "Three Gringos," he thus narrates, in Harper's for September, some of his experiences:

"At every hundred yards or so there were giant trees with smooth gray trunks, as even and regular as marble, and with roots like flying buttresses, a foot in thickness, and reaching from ten to fifteen feet up from the ground. If these flanges had been covered over, a man on muleback could have taken refuge between them. Some of the trunks of these trees were covered with intricate lacework of a parasite which twisted in and out, and which looked as though thousands of snakes were crawling over the white surface of the tree; they were so much like snakes that one passed beneath them with an uneasy shrug. Hundreds of orchids clung to the branches of the trees, and from these stouter limbs to the more pliable branches of the palms below white-faced monkeys sprang and swung from tree to tree, running along the branches until they bent with the weight like a trout rod, and sprang upright again with a sweep and rush as the monkeys leaped off chattering into the depths of the forest. We rode through this enchanted wilderness of wavering sunlight and damp green shadows for the greater part of the day, and came out finally into a broad open plain, cut up by little bubbling streams, flashing brilliantly in the sun. It was like an awakening from a strange and beautiful nightmare."

INSECTS.

"I have camped in our West, where all you need is a blanket to lie upon and another to wrap around you, and a saddle for a pillow, and where, with a smouldering fire at your feet, you can sleep without thought of insects. But there is nothing green that grows in Honduras that is not saturated and alive with bugs, and all manner of things that creep and crawl and sting and bite. It transcends mere discomfort; it is an absolute curse to the country, and to every one in it, and it would be as absurd to write of Honduras without dwelling on the insects as of the west coast of Africa without speaking of the fever. You cannot sit on the grass or on a fallen tree, or walk under an upright one or through the bushes, without hundreds of

some sort of animal or other attaching themselves to your clothing or to your person. And if you get down from your mule to take a shot at something in the bushes and walk but twenty feet into them, you have to be beaten with brushes and rods when you come out again as vigorously as though you were a dusty carpet. There will be sometimes as many as a hundred insects under one leaf; and after they have once laid their claws upon you, your life is a mockery and you feel at night as though you were sleeping in a bed with red pepper. The mules have even a harder time of it; for, as if they did not suffer enough in the day, they are in constant danger at night from vampires, which fasten themselves to the neck and suck out the blood, leaving them so weak that often when we came to saddle them in the morning they would stagger and almost fall. Sometimes the side of their head and shoulders would be wet with their own blood."

Some Remarkable Trees in England and Abroad.

England, in common with other wooded parts of the civilized universe, possesses many ancient and historical trees, and though the question of age may often be a matter of blind faith, on the contrary the history is a matter of dry facts. Until the middle of the last century the natives of the New Forest pointed out the very tree under which King Rufus fell, an alder growing in a swampy spot beneath which, we read, the grass "squelched when the Red King fell." "Rollo's oak," which, according to legend, is that on which Rollo hung bracelets as a challenge, is just now causing the good people of Rouen great uneasiness because of its dilapidated condition, albeit it still flourishes on top—the spot, by the way, whereat old age first tells its tale.

In the East, historic trees are usually associated with the names of saints, one of the most famous of these being the Bo tree at Anuradhapura, in Ceylon, which has none in the world to compare with it. Its age is a matter of record, its conservancy has been an object of solicitude to successive dynasties, and the story of its vicissitudes has been preserved in a continuous series of chronicles among the most authentic which have been handed down to mankind; and its green old age would seem almost to verify the prophecy given when it was planted—that it would flourish forever. We have a contemporary report of the planting of this tree with grand ceremonies in 245 B. C.—a period of 2,140 years since—and it is still flourishing. There are other notable Bo trees, among other places at Benares, and it was from a shoot from this tree that that at Ceylon has grown.

Quitting the East for the nonce, we would notice some ancient historical trees which are to be met with in this country, some of the most celebrated being found in Sherwood Forest and in the surrounding domains of the Duke of Portland. One of these is the Major oak in Sherwood Forest, which giant is hollow; and although the entrance is only about wide enough to allow of a man passing through, there is room inside for twenty persons. The girth of this Major oak is 54 feet outside the root, 34 feet above the root, 25 feet five feet above the ground, and the mean girth is 38 feet 4 inches. The spread of foliage is magnificent. Another famous tree is the Greendale oak, which stands near the lawn of Welbeck Abbey, and in its prime must have been a tree of enormous magnitude. It is now, however, in a very bad state, its worn old limbs being held up by means of chains. The gap in its trunk was originally so wide that a former Duke of Portland drove a four-in-hand through it for a wager. Another tree, or rather trees, to be found in Sherwood Forest is known as the Butcher's Shambles, being a group of trees on the boughs of which Robin Hood and his merry men were wont, if tradition is to be believed, to hang their venison. In the same neighborhood also is another tree associated with the legends of the light-hearted outlaw, the Robin oak, a grand tree in its time, but now hollow, though hale.

Leaving England and returning to the East, we may note the Verbudda banyan, which is called Cubberbeer by the natives. This tree is believed to date from the second century of the Christian era, and in the neighborhood stood a banyan, which Heraclius, Alexander's admiral, described as big enough to shelter an army. This Cubberbeer answers to the description of Heraclius even now, the principal stems, numbering four hundred, inclosing an area 2,000 feet in circumference, the small stems outside having been estimated at 3,000. Tradition asserts that when some army passed by, 7,000 men were encamped beneath it. At the beginning of the present century the Rajah of the district used to make the tree his headquarters, lodging suite and guards, carriages, elephants, cattle and followers beneath it.

Sir Samuel Baker tells of some olive trees in Cyprus which must be very old, as they grow slowly. In Provence there are some planted over 200 years since, and these are not more than 15 inches thick. At Dali, however, there is one, the trunk of which is 29 feet in girth, that is still sound. Until 1871 Teneriffe had a

tree of vast antiquity and sad interest. When the island was discovered the inhabitants used to worship a dragon tree at Orotava, which was so old that it is reputed to have played some part in the Creation. This was in 1402. Humboldt measured the tree in 1799, and found the girth 45 feet, and at ten feet above the ground 36 feet, the height being only 65 feet. The tree was, however, blown down in 1871.

At Materea, by Heliopolis, is a sycamore which for over 1,000 years has been known as the "Virgin's tree," and still flourishes.

In the Old World the greatest tree is the African Baobab, and in the New World the Wellingtonia. At the mouth of the Senegal River specimens of the Baobab have been measured of over 100 feet in circumference, though it is never more than 60 feet in height, and becomes hollow at an early age. Dr. Livingston found one in which thirty men could sleep comfortably, and Humboldt tells of one in Senegambia wherein the negroes held their meetings. Adamson has calculated that some of these trees must be at least 5,000 years of age, by which time they are 30 feet in diameter. Among curiosities there is the bottle tree of Brazil, which swells from a slender base until, at half its height, the diameter is equal to the altitude, a similar genus being found in tropical Australia. We cannot close these lines without a reference to the so-called "living stones" of the Falkland Islands, where, owing to the strong polar wind, it is impossible for trees to grow erect, so Nature has made amends by furnishing a supply of wood in the most curious shape imaginable. Here and there are to be found in the islands singular shaped blocks of what appear to be weather beaten and moss-covered boulders in various sizes. These boulders cannot be turned over, they being tied to the earth by roots of extraordinary strength. No other country in the world has such a peculiar forest growth, and it is impossible to work these odd-shaped blocks into fuel, because the wood is perfectly devoid of grain, and appears to be nothing but a twisted mat of fibers. The above constitute a few of the remarkable trees of the world.—Wm. Norman Brown in the Gardeners' Magazine.

Paris Green.

It is estimated that more than two thousand tons of Paris green are annually used as an insecticide in the United States, since it is the most rapid and effective of the arsenical preparations used for this purpose. The chief difficulty in using it is the readiness with which it settles to the bottom of the tank of spraying apparatus. This is because it is less finely divided than London purple—a point in which the latter compound has a certain advantage. In the last number of Insect Life Dr. C. L. Marlatt explains that there is no reason for this coarseness of grain in Paris green, except that the market has demanded a dark colored article, and the darker color is due to the larger size of the crystals. Paris green would be much more satisfactory as an insecticide if it were reduced to a fine powder, but it would then lose its intensity of color and become whitish, which, in popular estimation, would indicate adulteration. The fact is that the manufacturer who for years controlled the market did so because he had discovered a method of crystallizing the product in unusually large particles, which were, therefore, very deeply colored. Of course, it was less valuable in this form, and yet the dark green large-sized crystals were more difficult to manufacture and more expensive, and the country went on using this for years, although a more effective poison could have been made for less money. In testing Paris green when reduced to fine powder, Dr. Marlatt found that it remained in suspension three times as long as the ordinary product did, while, undoubtedly, the fineness in division made it more effective against insects. The last step in the process of manufacturing Paris green is the combination with acetic acid. When, however, this acid is omitted, an impalpable powder, instead of a crystalline product, is secured, and this will remain in suspension almost perfectly for many hours. Experiments are now in progress to ascertain whether this can be used as a substitute for Paris green, to which it is so superior in fineness, while it costs only half as much.

Good Counsel.

Young men of an inventive turn of mind should be constantly on the alert, observant in everything. Note where a saving of time or material can be effected by improved methods. If you cannot make two blades of grass grow in the place of one, invent some method to do certain things quicker and better than by present methods. Time is money, and any method by which time is saved has a commercial value. If the operation is performed better and quicker, the commercial value of the method or means enhances accordingly. The simplest inventions are of the most value, comparatively. A recent report from the Patent Office states that the majority of successful patents were for articles that retailed for one dollar or less.—Rural Mechanic.