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A DAY

WITH

THE SHOVEL-MAKERS.

BY

AZEL AMES, JR.

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The first of these is the fact that the
British Empire is a vast and
diverse collection of territories and
peoples, each with its own
history and culture. The second is
the fact that the British Empire
has been a source of wealth and
power for Britain for centuries.

The third is the fact that the British
Empire has been a source of
knowledge and learning for Britain
for centuries. The fourth is the
fact that the British Empire has
been a source of military and
political power for Britain for
centuries.

The fifth is the fact that the British
Empire has been a source of
cultural and artistic influence for
Britain for centuries. The sixth
is the fact that the British Empire
has been a source of scientific and
technological progress for Britain
for centuries. The seventh is the
fact that the British Empire has
been a source of economic and
social development for Britain for
centuries.

The eighth is the fact that the British
Empire has been a source of
moral and ethical influence for
Britain for centuries. The ninth
is the fact that the British Empire
has been a source of political and
social reform for Britain for
centuries. The tenth is the fact
that the British Empire has been
a source of international cooperation
and peace for Britain for centuries.

The eleventh is the fact that the British
Empire has been a source of
cultural and artistic influence for
Britain for centuries. The twelfth
is the fact that the British Empire
has been a source of scientific and
technological progress for Britain
for centuries. The thirteenth is
the fact that the British Empire
has been a source of economic and
social development for Britain for
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The fourteenth is the fact that the British
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Britain for centuries. The fifteenth
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ONE fine October morning we found ourselves in North Easton, where, as the smoke of the departing train cleared away, we saw before us, incongruously set in the very heart of the rural landscape, the metropolitan proportions and bustle of the most extensive shovel-works in the world.

The time-worn ledger of Captain John Ames, the stanch old blacksmith of Bridgewater, shows that as early as 1776 he had entered on this line of manufacture; and though the few hand-shaped and cumbrous articles he made were probably little known outside the limits of the Old Colony, the enterprise of his son, Oliver Ames, the water-power of the heads of Taunton River, and the midway location between the markets of Newport and Boston, established here in 1812 the works "whose trade-mark has become a key to the markets of the world."

The business has passed from father to son, and we met, on leaving the depot for our tour of inspection, a grandson of the old founder, who became our *cicerone*; and as we walked over to the works our attention was attracted by the numerous cars freighted with coal, iron, steel, or handles just arrived, or with manufactured goods ready for departure, which stood upon the "sidings." Here was one from Michigan with handles, that had not broken bulk since leaving their manufactory, and there another that, loaded with mining shovels, would not be unladen till it reached the Golden Gate. The early days of the business knew no such facility of transportation, but both raw and manufactured stock were laboriously carted to and from Newport, Providence, or Boston, and the first shovels Oliver Ames made were carried to Newport in his one-horse wag-

on. With the progress of the business the means of transit improved, and the one-horse wagon gave place to the six-horse team, and this in turn to the power of "the iron horse," whose roadway terminated at the manufacturers' doors. The buildings are all of stone quarried in the vicinity, constructed in the most substantial manner; and beside the central works there are scattered throughout the town shops for grinding, forging, etc., and at Bridgewater, Braintree, and Canton adjunct shops of very considerable proportions.

The building where the handles of the shovels are received and prepared for fitting to the blade is the initial one of the chain, and with it we commenced our tour. These handles are exclusively of ash, and for the most part are from Michigan and Maine, though many come from Canada; the latter, together with foreign steel, etc., being used entirely in orders from abroad, the entire customs "drawback" being thus obtained. Orders from Australia, South America, the Sandwich Islands, and the coast of Africa are the daily rule; and while we were there a large one, by no means the first, was received from China.

The handles come to the works in the perfectly straight and crude shape in which they leave their several manufacturing, which, being situated near the ash-growing sections, can more easily and cheaply produce them than could be done at the works; with the exception of a patent variety, which has several advantages over the older styles, and which is made here from the stock furnished by the handle manufacturing in a partially prepared state. The destruction of the ash forests of the country, and the fear that an adequate supply might fail, caused the manufacturers to consider how a retrenchment in the prodigal use of stock might be effected, and a handle equally serviceable with the old style produced; and the handle here made is the result of that consideration.

The width of the block required to admit of the old style hand-hole was

considerably in excess, as will readily be seen, of that required for the shaft or cylinder of the handle alone; and thus a large amount of wood that could not be rendered serviceable was thrown away in the making. To obviate this difficulty, a straight staff of the required length and calibre of the handle is turned out, and forwarded to the works at Easton, where, in a shop exclusively for that purpose, it is shaped by beautiful machinery into a handle possessing all the advantages of the old style, minus the clumsiness and plus a peculiar beauty and strength. The stick is first sawed at its head, or handle end, through the exact centre longitudinally for about six inches, and is then thoroughly boiled, after which the split is opened by a machine to the proper width for the hand, and at the same instant a block of exactly the size and shape the opening is desired to take is introduced, and retained till the shape is secure. A turned cross-piece is placed between the heads of the sides thus separated and riveted in; the whole is then trimmed up, and a tasteful, durable handle, with every requirement met, is thus produced, at the very considerable saving in stock of over sixty per cent.

When the handles are received at the works they are damp, green, and liable to shrink, and require, before being fit for the operation of "bending," to be thoroughly dried. For this purpose they are conveyed to the drying-room, where they are placed on raised platforms underlaid with steam-pipes, and hung up by thousands to the ceiling, so that on entering one might readily imagine himself in a cave overhung with a new species of stalactite. The temperature is maintained at 110° Fahrenheit, and here they remain as long as their condition requires, and are then removed to the bending-machines. So common an article as a shovel-handle would hardly attract a passing thought in every-day life; but here are evidences that years of toil and experiment have been spent to make only one of its features the complete fulfilment of its requirements.

attain the proper, short, double curvature near the blade, which is a necessity in every ordinary shovel-handle, more time and thought have perhaps been given than to any other part of it, and it is only in the present year that this process has reached its greatest stage of improvement.

On one side of the bending-room are so low, curious machines, suggestive of Inquisitorial racks; their victims entering, however, rather more quickly than those of old were wont to do, though with equally affected backs. Behind the operative of each machine is a tank of boiling water, in which a supply of handles is continually undergoing the softening process; for, being slight and brittle when they come in, they thus rendered pliable they would bend in every direction during the operation of being forced into conformity with the contour of the mould. As it is a large percentage is somewhat damaged.

The mould is of the exact shape the end of the handle is desired to assume, and is composed of two pieces, upper and lower, the upper embracing slightly more than half the calibre of the handle. This mould is laid upon a bed-plate of the machine, the lower segment in a groove, the upper being firmly keyed down upon it. The operative, seizing a handle from the tank, produces its end to the mouth of the mould, laying it upon its edge on the bed-plate, and fastens it quickly and obviously in its place by a clasp, an revolving arm coming up behind the mould, forcing it in its groove along the shaft of the handle, and conforming it to its curvature. The key of the upper segment is then withdrawn, the handle relaxed, and the now bent handle moved, the upper section of the handle being left upon it to keep it in position until thoroughly dried. A new section is put on for each handle, so on until the stock of uppers is employed, when the operative knocks from the earliest bent handle, and continues the repetition. Each machine is double, that is, has the same

apparatus on both sides, and until recently has required a man to each side; but late improvements bring it within the ability of one man to tend both, and a saving of labor is thus made. The two machines can thus bend four hundred and fifty dozens per day. On the opposite side of the room are the machines for boring the rivet-holes through the handle-heads; and successive improvements have converted what was originally one of the most painful and laborious operations in the manufacture into one of the lightest and most pleasurable of them all. In general oversight of the handle shop is the oldest man in the employ, both as to his own age and his time of service. Over sixty years in the manufacture, old John Bisbee has known every turn of its progressive wheel, and his recollections of the history and methods of shovel-making as it was before it approached the dignity of an art interestingly contrast with the narration of what it is. For seventeen years all the boring mentioned above was done by him with the common bit-stock, until the drain on his energies provoked his inventive genius and led him to water-power for relief; and when his first water-bit was set up and found to work successfully it was believed that the greatest possible improvement had been achieved; but one advance led to another in this as in the other departments of manufacture, and the neat little machine that now bores a dozen handles in the time we have been writing about it is complete in its way. A workman, powdered like a miller with the flying dust, places the handle-head in a rest designed for it, and moving a foot-lever, brings four smart little drills to bear; two on each side, one for the upper rivet-hole and one for the lower. In the old style of boring from one side only, the drill, when it broke through on the opposite side of the wood, was apt to make unsightly splintering; but here this is avoided by the bits entering from each side, and by the cam motion on which the machine works, it is so arranged that as one re-

treats, having penetrated nearly to the middle of the handle, the opposite one follows it just far enough entirely to clean out the remaining substance. The riveting through these holes was formerly done by heading one end of a nail-rod and driving it through the handle, filing it off just far enough from the wood to admit of a bur being riveted on. The cutting of the rivets to the proper length from rods, and heading one end by means of a bur, is now neatly and rapidly done by dexterous little machines worked by lads; and the operation of driving the rivets through and heading the other end with another bur, both burs being nicely countersunk, is quickly performed by one man. The upper part of the handle shops is occupied for storage, and by a small circular saw, with which such handles as have been split at the blade end, either in bending, as mentioned, or otherwise, are sawed off square above the split, and, thus shortened, are used for tunnelling shovels, principally in the Australian mines.

Next in order of manufacture to the handle shop come the "hammer shops," where begins that chain of processes which converts the bar of iron, the rough product of the rolling-mill, into the complete and attractive utensil ready for market and for use. Here on solid bases of timber and stone is ranged the thundering row of mighty maple helms with massive iron heads, and these with the fiercely glowing furnaces, and the swarthy forgermen hurrying to and fro, half hid in smoke, half bathed in the red light, make so weird a picture, that a stranger to the ceaseless stamp of the ponderous hammers, the fiery glow of the blasts, and the hissing shower of scintillating sparks, might well believe he had stumbled on the armory of Vulcan.

There are but three grand divisions of manufacture here, so far as metal is concerned, all tools being either "steel edge," i. e. of iron with a steel-service edge; "cast steel," i. e. a blade of steel with iron handle-straps riveted on; or "Antrim Patent," so called

from having been invented at Antrim, N. H., being a cast-steel plate with the iron handle-straps *welded* on, in which welding the patent process consists. The "steel edge" claimed our attention first; it is the cheapest tool made at the works and the one most largely in demand for the grosser work, as railroad and highway construction, cost being a consideration, and a fair serviceable article the requirement. To each shovel made here a definite number of pounds of metal is allowed, and each bar of iron after being weighed is marked off into such lengths as will be consumed to the best advantage in the different patterns made, and passes from the experienced workmen whose charge it is thus to apportion it to the heavy shears by which it is cut into the designated lengths with as much facility as a lady's scissors snip a thread.

Here, then, in this little cake of Norway iron, about as long as a man's hand and not quite as broad, we have the prospective shovel whose destiny it may be to turn up the "biggest nugget" the world ever saw, or break ground for the grandest enterprise man ever conceived. These cakes of iron are thrown into the furnaces, brought to welding heat, and then subjected to the hammers, upon whose polished surfaces a stream of water constantly plays and washes away the scale their steady stamp throws from the iron in the "necking down." By the process to which this term is applied, the middle of the red-hot piece of iron is lengthened and narrowed, and the whole beaten out, until we have two plates connected by a strap or "neck"; a depression being made in each plate by the pointed hammer close to the neck, which depression ultimately becomes the handle-socket. A few strokes at the hands of the hammers-man's assistant bends over this neck as it lies upon an anvil, and we have, as it were, two thin and narrow shovels, lying one upon the other united by the bent strap. Having again passed through the fire, the shoulders of these twin shovels are welded together by a hand-hammer,

and, coming a third time from the furnace, a strip of steel the width of the shovel is inserted between the open lower edges, and thoroughly welded in, giving the "steel edge." The shoulders and lower edges have now been united, and before welding the bodies of the two plates perfectly together, it is necessary that the small opening between the shoulders made by the hammer-point should be preserved in some way for the handle-socket. For this purpose a handful of earth is introduced into the cavity and the iron flattened, to retain it, by a light blow of the hammer. The shovel-form is then re-heated and thoroughly welded, during which process the earth becomes so much oxidized and beaten out as to suffer the walls of the socket sometimes partially to unite, and require opening by the driving in of a mandrel by the welder. These crude shovel-blades are now removed to another shop, the largest of the hammer shops, and here undergo the "plating and smoothing": the first consisting in repeated passage of the form through the fire, and under the hammer, until the desired size and thickness are attained; the "smoothing" being the evening of the surfaces and the finish work of the hammers. The deftness with which the forms are turned and manipulated between the quick and heavy blows of the hammers, and the action of these is brought upon any desired spot, is surprising and fascinating to a looker-on, and might well confirm Goulding's Jack Tar in his opinion, that "there are smart men in the world beside sailors." Bidding adieu to the heavy hammers, the now smooth and even-surfaced plates pass to an operative who stands before a machine, that on inspection we find to be a heavy pair of shears, the cutting parts of which consist of an upper strong steel knife just the shape the shovel-blade is intended to be, and a lower knife of the same shape, but a line larger. The upper knife barely works by the lower, — as one blade of a pair of scissors works by the other, — moved up and down in

a groove by immense power, beautifully shearing the hitherto wavy-edged plates, which are laid upon the lower knife, to true and uniform blades, cutting off the "neck" at its bend, so as to leave two pointed straps. Then the plates drop to the floor and are conveyed to the punches. The scraps of iron and steel which come from these shears as the trimmings of the various styles of blades, with all other scraps resulting from the different operations, are carried to the rolling-mills of the establishment at Canton. They return thence as sheets and bars from which the handle-straps for the cast-steel shovels and the caps of the spades are cut by operations to be hereafter described. The "punches" pierce two holes through the front and back handle-straps for the rivets which are to pass through the handle, and the blades are then thrown into the furnace to be heated for the action of the "drop-press," which is to give the surface contour of the shovel; for up to the time of reaching this press we have had only a perfectly flat blade, briefly serviceable perhaps as a weak snow-shovel, but without the curved-up rims and back imparting stiffness and forming the hollow which retains and conveys the material shovelled. The "drop-press" is a miniature pile-driver; the weight being of just the shape the shovel-blade is desired to assume, and instead of the pile we have the red-hot plate lying upon a die hollowed to conformity with the convexity of the weight, which is the upper die, and this, being forced down, presses the plate between itself and the lower and into similarity with the contours of both. To insure that the handle-socket already mentioned be not closed up, a triangular indentation is made in both the upper and lower die, of the precise shape the socket should maintain; and before the plate is removed from the press a mandrel is driven in, spreading the walls of the socket to the full extent of the indentation. The plate edges are next filed to the proper degree of sharpness and smoothness, and

the punching of the remaining strap rivet-holes ensues. The hardening process follows, and from this the blades pass to their final "setting," as it is called, which is performed by hand-hammers on common anvils, and is simply the complete evening and straightening of all irregularities of the surface and edges; and the row of men and boys engaged in this division of the labor creates not a little of both noise and interest.

The fitting of the handles to the blades follows the "setting," and consists of three operations, of which number one is shaving off the end of the handle obliquely to fit snugly into the point of the socket; number two is fitting the handle between the straps, and boring the holes for the rivets with a bit-stock, for which no substitute in the shape of a machine has yet been devised; and number three is riveting the handles and blades together.

The straps have, of course, remained perfectly flat throughout these operations, but must now be bent to conform with the rotundity of the handle and made to lie smoothly and closely upon it, that the hands of the shoveller may not be lacerated in using. To effect this the handle is passed through an ingenious pair of rollers, which bring the straps into close contiguity with the wood, but their edges require further depressing, and are therefore "set down," as it is termed, by hand-hammers, that is, beaten into the wood; for without this, when the straps were brought into contact with the emery-wheel in polishing, these edges would be worn off thin, weak, and jagged. We have seen that the socket in the blade was shaped by a triangular depression in both dies of the drop-press into a cavity with a diamond-shaped orifice, which it is plain the round shovel handle would not completely fill, and the stopping of the interstices constitutes the "wedging." This is done by boys who drive in wedges of cedar, cut by a sort of lever chopping-knife from long strips of the wood sawed in the neighborhood. From the lads who

wedge them, the shovels—and having now got their integral parts together, we may dignify them by the name—pass up stairs to a room in the great building of the chain, which is itself seven hundred feet long, where a row of spark-emitting emery-wheels are putting a beautiful polish on all the utensils subjected to their touch; fifty tons of emery and one hundred and twenty barrels of glue being used per annum in their construction and repair. The metal having received its polish the handle comes in for its share of "company dress," and under the action of swiftly revolving bands, covered with pulverized quartz, puts on a clean face at the same time that it covers the observers with the shower of dust removed. After this belting, the polished shovels are varnished, and all undergo careful inspection. So thoroughly systematized is the minutest item of the manufacture, that an imperfection in workmanship or stock is traceable at once to its author; for every tool made in the works bears on it the individual mark of every operative through whose hands it passed,—the steel shows its maker, and a comparative record keeps even the quality of the emery always under review.

The cast-steel implements next engage our attention, and the processes of their manufacture differ from those of the "steel edge" in many essential particulars. The steel arrives at the works in sheets of the required width and thickness, and is cut into "moulds," as they are termed, of the desired dimensions, the width of the sheet being the length of the shovel or spade. By a cutting-die the shoulders and points are sheared to the rotundity always observable in these tools, and the moulds then pass to the grinders, by whom the scale is removed from their surfaces. The slightly rough points and edges are smoothed and sharpened on a grindstone, and the plates then go to an operative, who passes them rapidly through a "punch," by one movement of which eight holes for the rivets of the handle-straps are made; and, hav-

ing been brought to proper heat in the furnace, they are placed in the drop-press, whose action here is similar to that witnessed upon steel-edged shovels. They are then "set," or trued by an air-hammer making four hundred and eighty strokes per minute, afterwards re-trued by hand-hammers, and are then placed in a bath of diluted sulphuric acid, in which they remain long enough to remove all remaining scale, that their polishing may be more perfect. From this they are transferred to a lime-water bath, which negatives further effect of the acid, and from this they pass to the emery-wheels to be polished. They are then smoothed with finer emery, oiled, and inspected, when they are ready for the riveting on of the handle-straps. These straps, cut from the sheets of re-rolled scrap iron, are stamped out by cutting-dies in two ways; by the first of which a large back strap is punched from the centre of the sheet, consisting of a triangle, with slightly bulging sides and a straight base, with a long strap running from the centre of the base: the triangular part to be riveted to the blade, and the strap to the handle. This, having been stamped from the centre of the sheet, there is left on each side of the cut whence it was taken a narrow piece from which an oval-headed front strap is stamped; thus completely using up the stock, a large strap and then two small ones being cut, until the sheet is exhausted. But by this means twice as many front as back straps are obtained, and to equalize, some of the sheets are cut into back patterns only, an alternation obliquely of the broad and narrow parts equally well utilizing the stock. The straps are then rolled out to proper length and tapering thickness by a wonderfully ingenious machine, in which the action of the rolls is so graduated as to exercise their force in increasing degree, so that the iron is left thick where most strength is required, and reduced to thinness where this is less requisite and clumsiness is to be avoided. The edges of the straps are

"swedged," i.e. in effect bevelled off; they are then annealed, shaped to conform to the blade-surfaces, their rivet-holes punched, their square ends pointed, and both are ready to be riveted on, in which process the front strap is first, and, both being secured, the point of the socket is riveted, and the shovel-blades pass to their handling, the processes of which are identical in all varieties, and have been witnessed already.

We come now to the shop of the "Antrim Patent," the pet of the works, and, beyond doubt, the best shovel in the world. As its main point of difference from the cast-steel implement lies in the *welding* on of the straps, we need not describe its manufacture much further than that. The "moulds" of steel are placed *seriatim*, under a pony hammer just adapted to scarf the plate at the point on its edge where the strap is to be joined; in other words, beating out a little lip, on to which the back strap may be welded. The straps of this shovel, unlike those of the other varieties, are not cut from the re-rolled scrap-iron, but from the best "Swedes," and it is designed that all the advantages of the patent handle, the improved method of manufacture, and all new approved devices shall unite in this, and sustain the reputation it now holds unchallenged as the *ne plus ultra* of shovels. The back strap is welded to the scarfed edge by a pony hammer, two holes are then punched in the "mould," and the front strap, which has been previously stamped out into much the shape of the back strap of the cast-steel shovel, is riveted on, simply that it may be firmly held in the proper position for welding. They are then reheated in a furnace especially designed for the purpose. As it is necessary to have only that part of the plate to which the triangle of the strap is attached brought to welding heat, an opening of just its shape and size is made through the bed of fire-brick on which the plate is laid. Through this the concentrated heat of the furnace is forced, by a blast upon the

surface thus circumscribed, quickly bringing it to proper condition for the action of the hammer, the face of which is so formed as to bear only on the edges of the triangle, leaving the socket undisturbed when the weld is made. This being completed, the further processes are those used with the other shovels.

Every description of shovel is made at the works, from the toy for the children to the great grain-scoops used at the elevators; and orders for particular patterns are of daily occurrence. The long and short handled square and round point shovels of common use form the bulk of the manufacture, and to these succeed the spades, mining shovels, grain and coal scoops, Benham's army shovel, "hedgers," — narrow spades used in setting out the Osage hedge, — and a score of others, which, in their processes of manufacture, are all nearly identical with one or the other of the divisions we have described.

We have thus traced to their completion the now brilliantly polished implements, that, though destined for the arts of peace, make the grand ware-room of the works to glitter like an arsenal, and stand silently suggestive of labor to be done and enterprises to

be accomplished. The march of improvement has here been unfaltering, not alone in the ever-increasing manufacture that gave, as the product of 1845, twenty thousand dozen shovels, and of 1869 one hundred and twenty thousand dozens, but also in the measure of employment given and the quality of the work produced. A thousand tons of iron, two thousand tons of steel, and five thousand tons of coal pass yearly through the hands of the five hundred workmen into the great works, and reappear as those humble but invaluable implements.

When the old founder had in great measure given over to his sons and grandsons the active charge of affairs, he one day complained — as old men are apt to do — that the quality of the work was not equal to that he had turned out in his more active days. It happened that, not long after, the Governor sold the unused arms of the State, lying in its arsenal, and with them half a dozen shovels of the old gentleman's early make, which his son secured and sent home; but when the old manufacturer came to see them, and found, honest and solid as they were, how far inferior they were to those then being produced, he declared he "never made them."

1884

the manufacture

in about 2500 days

