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Fig. 1.

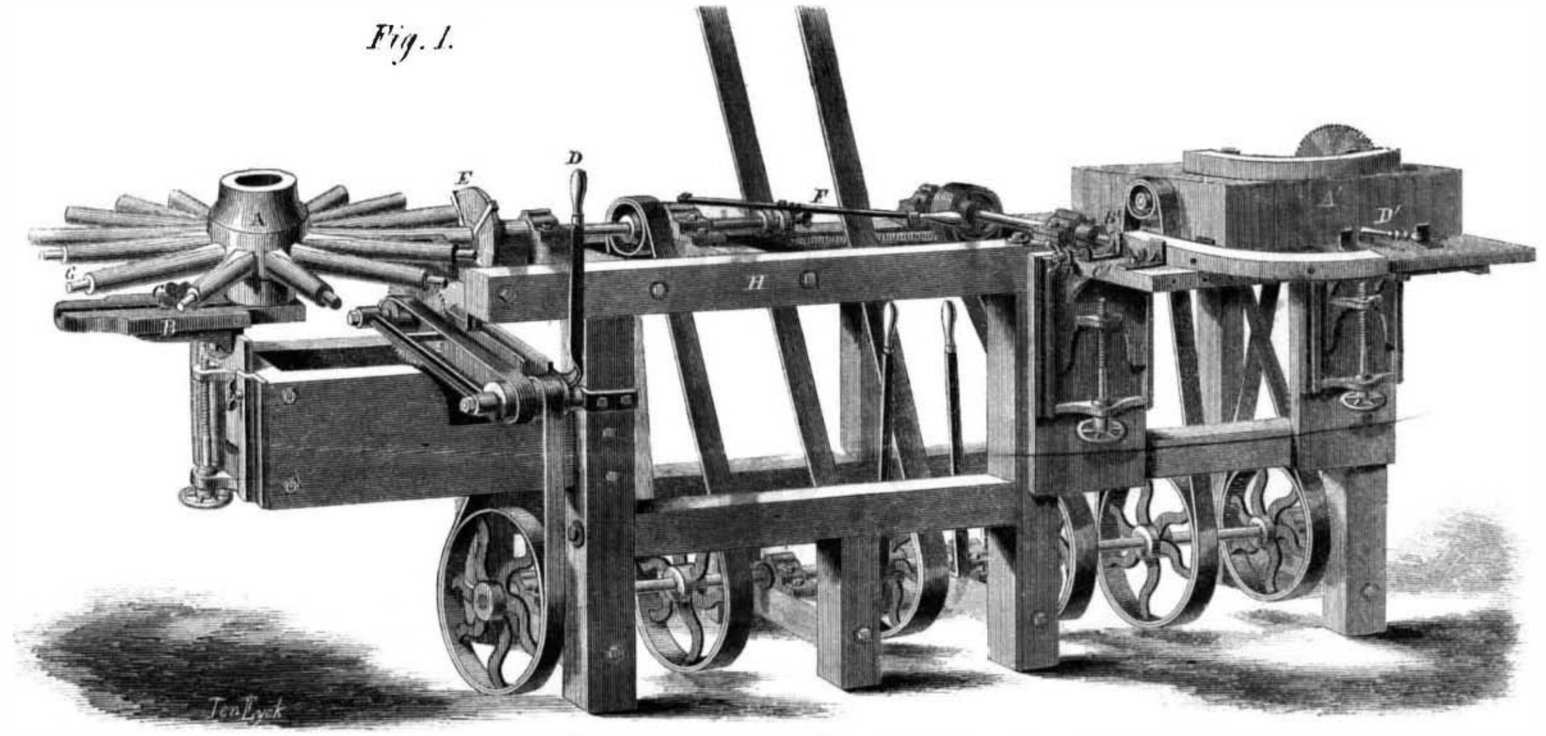
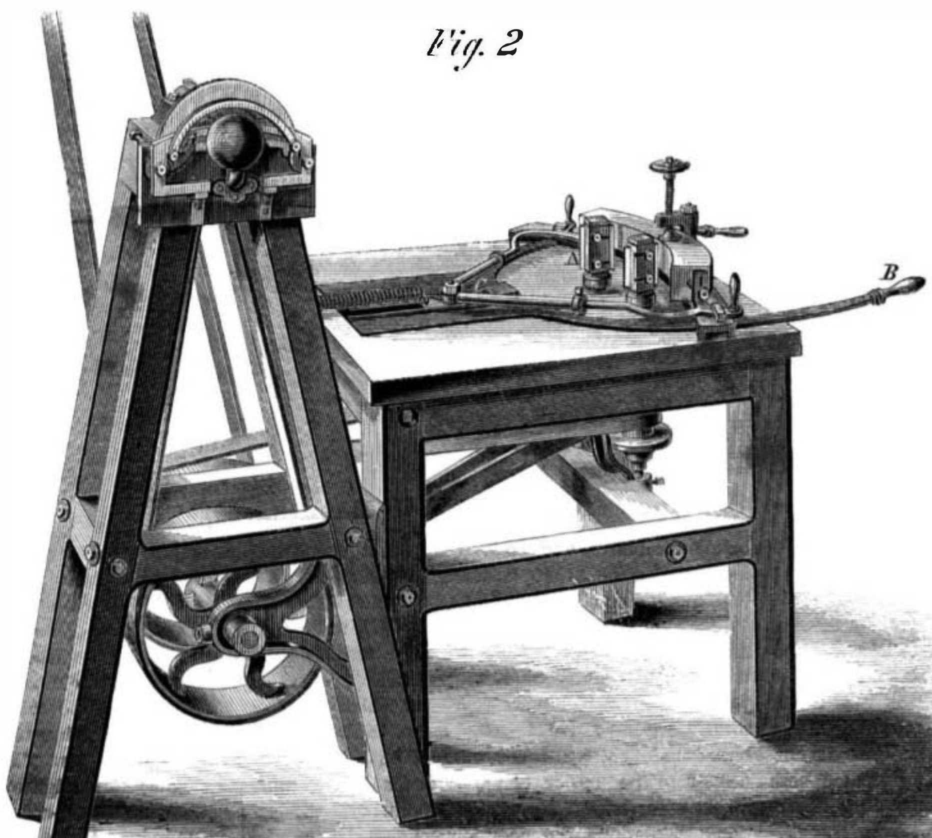


Fig. 2



JACOB'S SYSTEM OF WHEEL MANUFACTURE.

The process of making wagon wheels by hand is a tedious and most unsatisfactory one, on some accounts, as the excellence of the finished product depends entirely upon the skill of one man. Indeed, the individual who takes the wheel in hand to perform the last touches may, by his want of skill, impair the work of better men who preceded him. There are other considerations involved which render the adoption of machinery desirable in this branch of manufacture.—The saving in time is also an important item in these days of competition.

Jacob's system of wheel-making, which is here illustrated, takes the wheel after the spokes have been inserted in the hub, as shown at A, Fig. 1, and from this stage onward entirely completes the job, so that it is in all respects a finished piece of workmanship. To do this duty three machines are provided. The first of them is the figure above. In this machine the wheel, A, is placed on the table, B, and fastened there by the fixtures, C, so that while it is perfectly firm it is also free to revolve on its center. A circular saw is then brought up by the handle, D, so as to cut off the end of the spoke to a certain length. This operation having been performed, the hollow auger, E, is moved up by the lever, F, and the shoulder, G, on the spoke, is also made to a specified and previously-set distance from the center of the wheel. When the fellies are put on, therefore, the wheel will be comparatively true all round, and the several parts will have a neat fit, one with the other.

These details just described are all fastened to the frame, H, and are driven by the belt seen above.

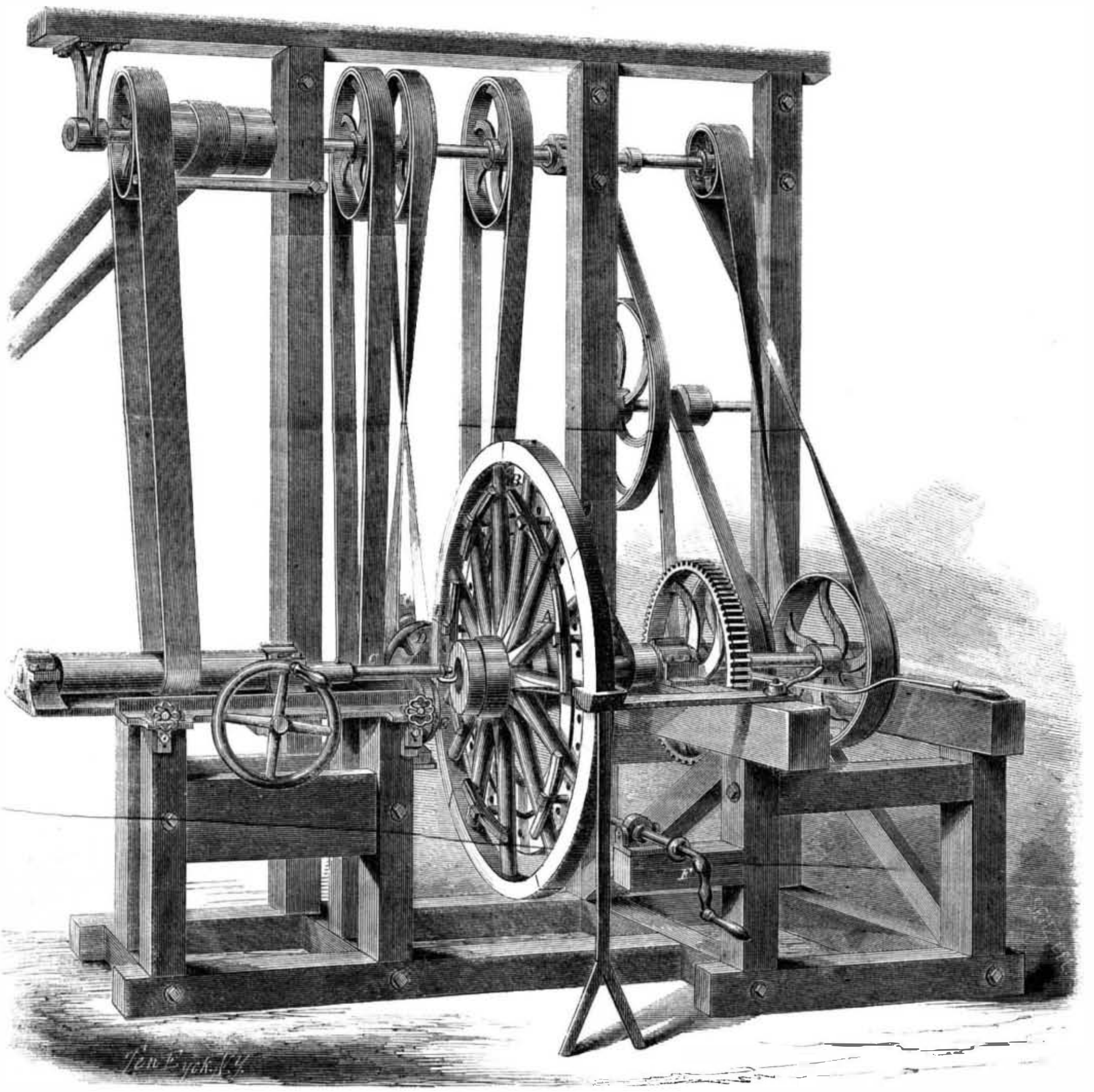
At the right of the frame may be seen the appurtenances by which the fellies are fitted up. The fellies have previously been sawed out to the proper radius. The ends, however, have to be squared off, and cut to a certain length. This is done on the table, A'. By the use of gage irons, set in the table, the end of the felly is always made perfectly square with the radius of the circle it is on. The holes for the dowel pins in the end are then bored by the bit, B', and the gages, C', also guide the work so that it is perfectly true with the joint face. The spoke holes are bored with the bit, D', by the use of gages also.

After the fellies are bored they are removed to the machine seen in Fig. 2. This machine dresses the entire inner surface of the felly, rounding it off perfectly to any desired curve, and forming a handsome oval about the spoke hole. The rounded surface is given by the cutters, A, which run at a high velocity and are made of any shape desired. The felly is carried about the cutters by moving the lever, B, and there is a slot of peculiar shape in the table at C. The oval above alluded to is formed by moving the fellies away from the cutters to a certain distance. Another rounding machine for bent fellies is shown in the vertical frame, D. This machine makes a perfect semicircle, leaving no flat or plane surfaces to be removed by hand afterward. The cutters can be made to work as close to the spoke holes as desirable; this feature is novel and has never before been accomplished

After the wheel is all put together, which occupies but a few minutes, so perfectly do the parts unite with one another, it is removed to the machine seen in Fig. 3. This machine dresses the whole surface of the wheel rim and bores the hole for the box at one time, and is to us the most interesting one of the series. The wheel having been chucked on the face plate, A, is fastened by the clamps, B, in a few seconds. The boring bar, C, is then set revolving at a high rate of speed, while the wheel itself runs in the opposite direction. The cutters in the head, D, then revolve against the tread of the wheel, while the cutters in the heads, E, one on each side, dress off both faces of the rim at once, being graduated as to the amount of wood they remove by the handle, F.

The result of these several operations is to produce a most beautiful wheel in a very short time. Fifty heavy wheels a day is a fair average for one set of this machinery. All the joints are perfectly true and smooth, and the entire appearance is neat and mechanical.

These machines were patented through the Scientific American Patent Agency, Sept. 15, 1863, by H. S. Jacobs, in England, France and Belgium. A company has been formed to work these machines, and some of them are now in operation at No. 147 Bank street, this city. For further information address Jacob's Patent Wheel Dressing Machine Co., 99 Wall st., New York. The entire patent is for sale.



WHEEL MANUFACTURING MACHINE.

French Bread-makers.

The trade of baker must have been in the olden time one to try the temper of the most patient of men. At one period, a Paris baker could light his oven only on 290 days of the year. He could not bake on Sundays, and we are told that it was amusing to watch the bakers standing in their doorways on Monday mornings with their ears stretched, to catch the first sound of the matin-bell, when they might light their ovens. Then there was the great trial of the Queen's bread, in the making of which yeast was used, and in the course of which the doctors, called in to give their opinion as to the effect of bread made with yeast on health, fell out, to the great delight of the author of the *Malades Imaginaires*. If, however, in all these times of trouble and of vexatious regulations, the poor journeyman baker was seldom at peace, at least he had the comfort of looking forward to the time when he might marry his master's daughter, and set up a shop for himself. But the poor journeyman bakers of to-day, who flit fretfully about in the twilight and in the dawn, have no such hope left. Capital, which they can never have an opportunity of amassing, is necessary to open a baker's shop, even now when the monopoly has been destroyed. Here he will remain where I see him now, on this bleak winter-night, in this stifling celler under the shop, with the red-hot mouth of the oven almost singeing his body, making and baking the bread of his fellow-man to the end of his short life. Little unbroken rest has he, even by day, for he must watch once or twice in the daytime the preparation for the night's batch of bread. The labor of kneading it is most unhealthy to him, driving the particles of flour into his lungs, and cannot be advantageous to the bread. Still, the Paris journeyman baker vehemently opposes the introduction of kneading machinery, in the fear that it will leave him to starve; and up to this moment he has been able to restrict the use of bread-making machinery within very narrow limits. Although his wages are low, and his hope of advancement is almost *nil*, he clings to the old system, albeit it must bring him to an early grave. The labor of a working-baker is so hard that apprentices to it are seldom entered younger than eighteen years of age. The apprenticeship lasts during a year or eighteen months, and the premium paid to the master-baker fluctuates between five and six pounds. At the expiration of this short apprenticeship, he becomes a brigadier. It is his duty to heat the oven, to put the bread in it, and remove it, and generally to exercise the functions of a foreman. In the bakery with him is the important workman called the first help. It is he who kneads the bread, sending forth, as from the bowels of the earth, the groans and piercing cries that affright the late-returning merry-makers. He shapes the dough into loaves, with the assistance of the second help.

The first help earns about three-and-sixpence per diem; and his assistant has between half-a-crown and three shillings per diem. A fourth workman generally completes the staff of an ordinary Parisian bakery. This last is the drudge; he chops the wood, fetches the water, counts the loaves, and, in short, does all the needful drudgery, for something under two shillings per diem. The poor bakers are, I may observe, paid for overwork in this way. When they have to bake more than seven batches of bread, each batch containing seventy loaves, the workmen receive fivepence each for the eighth batch, and a penny each for the ninth. In addition to these money-payments, each workman is allowed to take away two pounds of bread daily, and it is this two-pound loaf that we have so often seen under his arm, as he trots away through the morning cold to his bed. He is allowed, moreover, to eat as much bread as he pleases during the night. There are indulgent masters, who give the poor fellows a sip of white wine before they start home in the morning; but these are, I fear, rare exceptions.—*Chamber's Journal.*

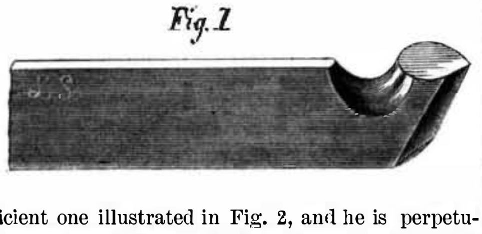
TURNING TOOLS.

PART FIRST.

There is no branch of the machinist's trade which is more interesting or important than that relating to the lathe and its management. Of two men working side by side with the same lathes, and on the same kind of work, the same feed and speed, one will do much more than the other. We see this exemplified on piece work. Here the earnings of the workman are exactly in proportion to his skill, and though his comrades may take every opportunity to discover the secret of his success, he still outstrips competitors.

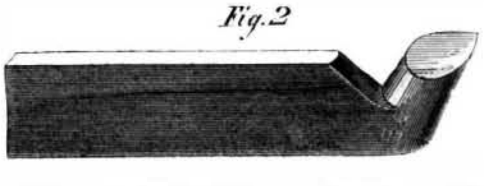
This is owing in most cases to the tools the skillful man works with. The unreflecting workman cannot appreciate some small matter in the construction of a tool, and suffers accordingly. He will most probably be contented to work with a clumsy tool, like the one shown in Fig. 1, instead of the more

Fig. 1



efficient one illustrated in Fig. 2, and he is perpetually wondering how it is that he is always behind hand.

Fig. 2



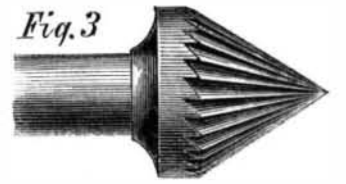
There is no mystery about the matter. A lathe tool works on one principle, as do all cutting instruments, and this principle is simply that of the wedge, as we have remarked in a previous article on boring tools, in the last volume of the Scientific American.

If a man has a heavy stone to raise, or a tough block of wood to split, he does not take a wedge which is thick and blunt, and almost as wide at the base as it is long. He uses instead a long, thin and easy one, which does the work with facility and celerity. The case is exactly the same when we cut iron or metals of any kind. To sever the fibers or crystals we must have sharp thin-edged tools, as thin as they can be made with economy. With these, and proper feed and speed, the work will be well done if intelligence superintend the operations. It is most essential that the tools be made sharp and kept so. If they are not, the work will be poorly executed. It is also of the first importance that the work be truly and properly centered. The center is the point on which the accuracy of the whole job depends, and it will be apparent to even the unprofessional reader that it should be perfect.

Very many workmen are content to take a center punch and make some sort of a cavity in the end of the rod, and "let it go at that," as the saying is. No good workman does this, but shiftless and indifferent ones do, and their work always shows badly compared with that done in a proper manner.

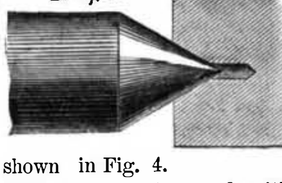
Every center should be drilled. The drill need not be larger than the tenth part of one inch, in ordinary work, and the object of drilling is to keep the point of the center in the lathe from bottoming. The centers in the work should be enlarged with a countersink, like the one shown in Fig. 3. But when the

Fig. 3



shaft is too heavy to be used in this way a square center is put in the place of the dead center of the lathe, a dog put on the shaft, and the job set revolving. The back end of a tool is then put in the tool post and screwed up tight, and the tool brought in contact with the running shaft. If the work has been drilled properly the sharp square corners make a countersink like the head of a screw, so that when the working center of the lathe is put in the spindle it will have a fair, solid bearing in the job, as shown in Fig. 4.

Fig. 4



The way a center, made with a center punch alone, acts, is shown in Fig. 5. Even if the punch is ground to an exact conformity with the lathe center, which is by no means likely, the center will not be true, as a rule, when the work is run over many times. For as the work revolves the orifice in the end of the shaft wears, where it bears on the lathe center. When the center comes to the bottom of the cavity, as it soon will, it stops there because its point can go no farther, while the larger or outer diameter of the centers wear away on the lathe center. This causes the work to be untrue; when a rough cut is taken off from the shaft and a finishing cut is to follow, the work runs "out," and not only spoils the looks of the job by leaving rough marks in one side, but ruins the work, for it is not round, and can never be made to fit in its place. There are many ways of making countersinks for enlarging centers. One commonly used, quite as efficient, and much cheaper than the former one, is shown in Fig. 6. Having thus made a brief but necessary digression from the subject of turning tools, let us resume the consideration of them.

Fig. 5

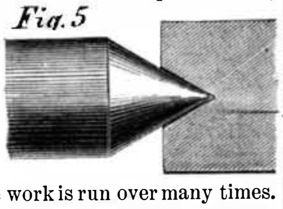
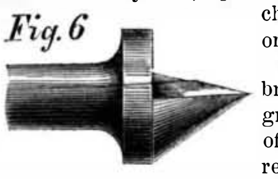
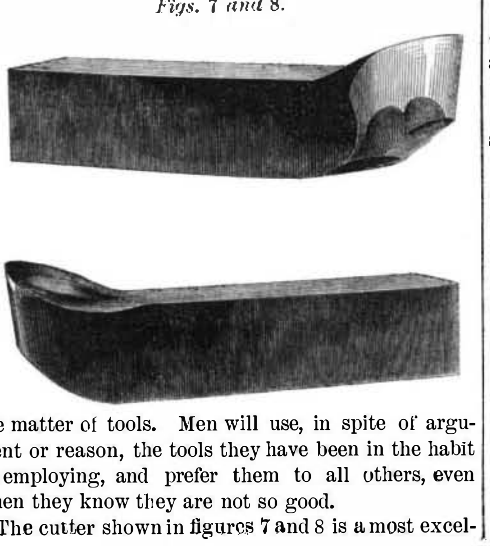


Fig. 6



The tool shown in Fig. 2, is a good roughing tool; it is called a diamond point, but there are very many turners who do not consider it the best for the purpose. It would be hard to say *why* precisely, for there is sometimes a great deal of whim exhibited in the matter of tools. Men will use, in spite of argument or reason, the tools they have been in the habit of employing, and prefer them to all others, even when they know they are not so good.

Figs. 7 and 8.



The cutter shown in figures 7 and 8 is a most excellent one; its virtues have been well tried and not found wanting. It is stout, cuts well, when properly made, holds a good edge, and will carry a heavy or a light cut with equal facility. These are the chief requisites of a good roughing tool. The management of it depends on the workman.

EXPANSION OF STEAM.

To the Editors of the Scientific American:—

Gentlemen,—

As I see that in the Scientific American of the 15th of October, you make some reference to a work of mine, I beg leave to make the following remarks on the subject of your article.

The circumstances under which steam undergoes expansion may be classed under five heads:—I. When the steam expands without performing work. II. When it expands and performs work, the temperature being maintained constant by a supply of heat from without. III. When it expands and performs work, being supplied from without with just enough of heat to prevent any liquefaction of the steam, so that it is kept exactly at the saturation point. IV. When it expands and performs work in a non-conducting cylinder. V. When it expands and performs work in a conducting cylinder, not supplied with heat from without.

I. When steam expands without performing work (as in rushing out of a safety-valve or through a throttle-valve) it becomes superheated, as is well-known; the temperature falling very slightly in comparison with the boiling-point corresponding to the diminished pressure. The precise rate at which the temperature falls is not yet known; but it will probably be soon ascertained through some experiments by Prof. Thomson and Mr. Joule.

II. When steam expands and performs work, the temperature being maintained constant by supplying heat through the cylinder, the law of expansion at first deviates from Mariotte's law by the pressure falling *less rapidly* than the density; but as the expansion goes on, the law approaches more nearly to that of Marriotte, as recent experiments by Messrs. Fairbairn and Tate have shown.

III. When the steam expands and performs work, *being maintained exactly at the temperature of saturation*, the law of expansion, as you observe, is perfectly definite. In the treatise to which you have referred I have shown what it is; and also that it is expressed nearly enough for practical purposes by taking the pressure as being proportional to the 17th power of the 16th root of the density; a function very easily calculated by means of a table of squares and square roots. In many actual steam engines, the circumstances of this case are practically realized, as is shown by the agreement of their performance with the results of calculation

IV. When steam expands and performs work in a non-conducting cylinder, it was shown by Professor Clausius and myself, in 1850, that the lowering of the temperature, through the disappearance of heat in performing work, goes on more rapidly than the fall of the boiling point corresponding to the pressure, so that part of the steam is liquefied. This result was experimentally verified by Mr. G. A. Hirn, of Mulhouse, a few years afterwards (see his Treatise on the Mechanical Theory of Heat). The mathematical law of the expansion in this case can be given with perfect precision; but its circumstances are not accurately realized in practice, because the cylinder is always made of a rapidly-conducting material.

V. Lastly, when the steam expands and performs work in a conducting cylinder, which receives no supply of heat from without, but is left to undergo a great alternate rise and fall of temperature through its alternate connection with the boiler and the condenser, the law of expansion becomes very variable, and the problem of determining it extremely complex. It is certain, however, that a great waste of heat occurs in every case of this kind, as Mr. Isherwood's experiments have shown. In a paper read to the Institution of Engineers in Scotland, about two years ago, I discussed some of Mr. Isherwood's earlier experiments, and showed that they gave proof of a waste of heat increasing with the fall of temperature due to the expansion of the steam, with the extent of conducting surface of the cylinder, and with the duration of the contact between the hot boiler steam and that conducting surface.