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SCRAPING SURFACES TO FIT.

There is no planer that planes planes. The best it can do is make a series of minute corrugations nearly parallel and nearly level. When a job of iron work comes from a planer, its planed surface is a series of longitudinal ridges traversed by cross chatter marks. Except in degree this description applies to all work done on the planer, whether the tool used was a roughing tool with rank feed or a finish tool with fine feed. Two planed pieces of cast iron laid face to face would present surfaces of contact very much like the plowed fields of clay soil, except in a less degree.

The first preparatory work to the scraping of surfaces to fit is testing with the straightedge, both longitudinally and across, to determine if the surface is out of wind. Inequalities are coarsely reduced by a float or mill file and afterward with a finish file, the straightedge being the guide. The finish file must be used with great care, for it is not its office to remove all the marks of the coarser file, or even to obliterate those of the planer tool; for both may present surfaces looser in texture than untouched portions, and thus be too quickly and unevenly cut away. All this preparatory work is to be done under the guidance of the straightedge—the surface plate has no part in it; the straightedge determines the lines of level, the truth of the surface, while the surface plate shows the quality of the surface.

A wash of spirits of turpentine put on with a rag is better than red lead to show surface. Soon as this is put on, place the surface plate on the surface of the filed work, and rub it back and forth. This will show the condition of the surface, which will be in blotches and dots. All these bright blotches and dots should be scraped down, the finer dots and lines less proportionally than the broader blotches, and another trial with turpentine and surface plate made, to be followed again by judicious scraping. It is not expected that working surfaces are to be as perfect as those of the test straightedges and the surface plates; the surface of the work should be even, without elevations or depressions, and should test to a straight line in all directions.

Scraping to fit is a slow, patience-demanding job; but it does not require the absolute exactness of the testing tools. Some of the tests for these are remarkable. When two surface plates, thoroughly clean, are laid together, one may be moved over the other at a mere touch, as though there was a film of ice between; the reason is that there is really a film of air between the surfaces, and it requires some force and movement to displace this air layer, when the plates will adhere so that one may be lifted by raising the other. Let one straightedge be laid on another, face to face, and then move one end of the upper one transversely back and forth as though it was mounted on a pivot. After a few attempts a pivot will be found at a point about two-thirds or three-fourths of the entire length of the straightedge from the moving hand. But if these surfaces are left in contact for a while, they require force to separate them. A test was made of balancing a straightedge three feet long and weighing thirteen pounds on a human hair. It was placed on another straightedge, and the hair introduced between the two faces near the center. The upper one was moved on the hair as a roller until the proper point was reached, when it remained balanced perfectly, so that light could be plainly seen the entire length of the straightedge between the two surfaces, except where the hair separated them at the middle of their length.

HANDLES FOR COLD CHISELS.

The cold chisel is the crudest tool used by workers in the metals, albeit one of the most effective; it is a bar of cast steel with a wedge edge, varying from a parallel blade to a gradual thickening from edge to stock. Its work is always by percussion, and the material of the hammered head and the driven edge is the same, only that the latter is hardened and tempered. And yet, for some purposes, the cold chisel should have a handle of material differing from that of the bit or cutting portion. When the chisel is entirely of steel the blow is transmitted, with all its direct energy, to the edge. In many instances this blow "stunts" the edge, and leaves the thinner portion in the cut. Every "chipper" knows that much of his success depends on his skill in preventing this mishap. Yet for most of the ordinary work of the chipper the solid steel chisel is the best; on cast iron especially, and for starting and driving a keyway in wrought iron. But for the final chip, the finish, especially in yielding metals, as brass, wrought iron, and soft steel, is better done with a chisel that softens the blow before it reaches the cutting edge. This can be accomplished by means of a wrought iron chisel with cast steel bit, the two being welded together. With such a tool, light, thin, smooth shavings can be taken, leaving the work almost free from the chatter marks that necessarily accompany the use of the solid steel cold chisel. These chisels were tested many years ago, and were proved to be excellent for the finish work on a job. They have not come into general use, probably because of the trouble and cost of making and relaying the chisels.

For very delicate work, even wooden handles are—or have been—successfully used. The channeling of some small steel dies for working soft sheet brass could not be done by the solid chisel, but the work went well when the chisels were inserted in solid wooden handles. The handles which were fitted with screw jaws for holding the shanks of awls, small wood chisels, screw drivers, and similar tools, proved to be excellent for these light purposes. These wooden handles were fully as effective in chiseling by blows on copper and hard brass, when the solid steel chisel lodged in the metal or broke its edge if the blow was not in a direct line with the chisel.

The Only Foreign Policy Wanted.

We know of a vigorous foreign policy to which there is no possible objection. It is a policy of peace which misses no opening for an increase of trade between the United States and other countries. It affords scope for the largest statesmanship and for the freest employment of all the arts—save that of war. This is a policy loved by the people more than by ambitious rulers. It is devoid of noise, fuss, and pretension. We have seen it manifested within a year in the building of a railroad between the United States and the heart of Mexico. This one American enterprise, popular in its inception and completion, has done more to promote good will and quicken trade between the two countries than all the legislation of Congress since the Mexican war. Among its incidental interesting results is the movement for a meeting at St. Louis of the Mexican and American survivors of the war of 1846–47. This is the first assemblage of the kind ever convoked. It would not be possible but for the truly friendly relations which have sprung up between the veterans of Palo Alto, Monterey, Chepultepec, Contreras, and Cerro Gordo on both sides of the boundary, in direct consequence of the new railroad communication.

Private citizens can do much in this line of reciprocal kindnesses, but they cannot do everything. The tariff barriers which divide us from Mexico cannot be leveled except with the consent of our Government. Here now is an auspicious occasion for bringing into play a vigorous foreign policy that can hurt nobody, that will cost this country nothing, and will bind Mexico to our interests as tightly as if she were annexed as the result of an expensive war with her. There is no "jingoism" about this. There is no necessity for waiting of a new President, Republican or Democratic, to put this practical and feasible idea into execution. It can all be realized by the passage of the bill reported from the Ways and Means Committee to carry the Mexican treaty into effect. There is political capital in it for both parties; and Republican and Democratic members of Congress should gladly unite in the good work.

When this is accomplished, it will only remain to apply a similar policy of reciprocal trade to all the States in Central and South America. And lo! the dream of our destiny will have been practically realized without the loss of a single drop of blood.—*N. Y. Jour. Commerce.*

Explosion of a Cannon Mould.

At the South Boston Iron Works on the 9th of July a remarkable explosion took place during the casting of a gigantic cannon. Fortunately no lives were lost.

For three weeks these works have been manufacturing guns for the United States Government. The order was for five cannons of the largest bore, and three of them had been made.

Early in the afternoon the process of casting was begun on the largest gun. Three furnaces, each containing forty tons of melted ore, furnished the metal. The spectators had just left the room, and the firemen were filling up the cavities caused by the cooling of the metal. The men were standing a short distance from the pit when the explosion occurred, sending a column of molten iron to the roof, a height of sixty feet, and scattering it in all directions. The men fled, and fortunately escaped. The building was set on fire, but only the roof was destroyed. The cause of the explosion is a mystery. The company will not lose over $6,000. The building, pit, and machinery were put in by the Government in 1881, and the pit was forty-one feet below the surface. The gun if perfected would have been a twelve-inch rifle bore breech loader, and of the Rodman pattern. It would have been 38 feet 6 inches long, and would have weighed 120 tons. It was 3 feet 7 inches across the muzzle, and 4 feet 9 inches across the breech.

Grinding by Machinery.

For some time past a machine has been at work in Sheffield which has effectually solved the problem whether grinding can be done by machinery. It is the invention of James Mitchell. Not only can the machine do the work of five or six men, but the quality of the grinding is said to be superior to that produced by hand labor. It is almost automatic in its action, and it does its work so easily and satisfactorily that a boy is sufficient to attend to it. The machine is altogether unlike what had been expected. There is no large revolving stone like those to be seen in grinding mills; but its place is taken by segments or blocks of stone, fixed by wedges and screws into the ribs of a hollow disk. These stone blocks are set with their faces toward the object or objects to be ground; and they are so fixed that they can readily be moved outward as the face begins to wear. When the machine is set in motion, the disk rapidly revolves at right angles to a bed or bedplate. To this bedplate the objects to be ground are secured. It has a backward and forward movement, and as it moves the articles secured to it are brought into contact with the stones on the face of the disk. The rapidity with which the machine does its work in comparison with the results of hand labor is very striking. But not only is it capable of grinding flat surfaces, and truing up edges; it grinds concave or convex, and bevels and angles equally well. It will thus be seen that the machine can be used upon a variety of objects.

Curious Properties of Coal-gas.

The following is an abstract from a lecture by Mr. Thomas Fletcher, recently delivered at Cheltenham, England:

"When we consider how long gas has been in common use, it is surprising how little is known concerning its use. Until within the last few years most people have been under the impression that it was merely a means of obtaining light, and even for this purpose it has been, and, I may say, still is, most wastefully used. The majority of the people seem to think that if they only burn a quantity of gas it matters very little how the gas is burned, or what burners are used. As an example, I often see ordinary sitting-rooms about the size of my own—*i. e.*, 15x20 ft.—lighted by three or four burners, each being most carefully inclosed with opal or ground-glass globes, which waste about half the light. My own sitting-room is lighted by one No. 8 Bray's burner, and I may safely say that few rooms are so well lighted. People are not generally aware that one large burner gives far more light than two separate burners, each consuming 4 feet per hour, and that one burner without shade is about as good as two with opal or ground-glass globes. Many people prefer the appearance of burners with glass globes, but they must bear in mind that this entails a much larger gas consumption for the same light, and also more heat and vitiated air in the rooms. There are burners made of two small ones joined at a certain angle, which are said by the makers to give a great increase of light for the same gas consumption. The fact is that, as I show you, two burners, each burning 4 feet per hour, give far more light when both flames are joined in one, but they give little, if any, more light than a single good burner burning 8 feet per hour, and the compound burners are extremely liable to cause black smoke when turned low. I show you the two arrangements side by side, and you will see the fact clearly without further proof, although, of course, my experiment is a rough one. The truth of what I tell you has been proved by photometer tests repeatedly. There is another point not generally known, that if a burner is placed at such an angle as to give a flat or saucer-shaped flame, the light is greatly increased, but this has a similar objection to the compound burner—it is liable to smoke if turned low. A great argument against the use of gas is the smoking of ceilings, etc., and curiously enough these complaints come strongest from those people who burn their gas carelessly under excessive pressure without control, and under such circumstances that smoke is almost impossible. The liability to true smoke occurs only in places such as open shops, where the flames are blown about very much, or in those places where first-rate burners are used under the best conditions—that is, just verging on the smoking point. The fact is that the supposed smoke is not smoke at all; the discoloration is gray or brown, not black, as it would be with smoke, and is, I think, caused only by the dust in the air being more or less burnt, caught in the ascending current of hot air, and thrown against the ceiling. When the gas is first lighted the ceiling is cold, and the water formed by the combustion of the gas condenses, forming a surface to which dust readily adheres, and if we use any burner, whether oil or gas, in one fixed position, the discoloration above it is exactly the same, depending entirely upon the power of the burners used. When the servant lights the gas on a dark morning and proceeds to clean up the fire-place and dust the room, she does practically all the smoking of the ceiling which takes place; once the dust settles, little discoloration occurs after. I cannot keep you here six months to prove this practically, as it really occurs; in fact, the dust in the air is so minute in quantity that it takes a long time to produce visible effect, but I have seen sufficient of the results with experimental burners to be practically certain that this is the only cause of the so-called smoking of ceilings. It can be prevented to a great extent by a shade of any kind over the burner. The reason why lamps do not cause this discoloration is that they are not always in the same place, and they are as a rule of much lower power than the gas-lights ordinarily used in the same room. Gas can be burned most efficiently for heating purposes without any flame or visible combustion; in fact, flame is only a sign of incom plete or imperfect combustion, and, looking forward to a possibly near future, I believe that all fuels, both solid and gaseous, will be burned for heating purposes without any flame. I will show you how deceptive appearances are by making an enormous flame, in which I am burning, probably, at the rate of 100 cubic feet of gas per hour. This flame is a delusion; like an empty bottle, it is all outside and of very little use. Passing through the thin film of flame on the outer surface it is quite cold inside, and this I will easily prove. If it were large enough, I should not have the slightest objection to walk into the middle of it and remain there; not being large enough for myself, I will protect the stem of this thermometer from the outer film of flame, and put the bulb inside. It will register about 120° Fahrenheit. I will replace the thermometer-bulb by a ball of tissue-paper, and you see it is unchanged. I will protect part of my hand from the outer film of flame, and pick the paper out with my bare fingers; and, lastly, will place a small paper of gunpowder in the center of the flame and let it remain there. Such a flame as this, notwithstanding its apparent fierceness and size, is of little use. If you place a cold vessel in it, it makes an abominable smell. It is a mixture of gas and air, but in incorrect proportions, owing to the faulty construction of the burner, and the mixture can only burn on the surface where it comes in contact with the external air. By increasing the air-supply to the correct proportion, as you see, the flame is reduced in size, becomes solid to the center, and explodes the gunpowder. Carrying on my experiment still further, I now use a different burner of a much smaller size, and use air under pressure from a small foot-blower—as the burner I have been using would, with an air-blast, require about 1,000 cubic feet of gas per hour to work it—and I wish to show you, as near as possible, the same quantity of gas being burned under different conditions. This burner you now see is only 2¾ inches across the surface, yet, with the assistance of a small blower, it may be made to burn perfectly up to 200 cubic feet or more per hour—sufficient to make steam for a two or three horse-power engine. You can judge of the heat of the flame by the iron wire I put in it, which you see burns almost like paper. Changing the burner once again, I use a large blowpipe, which gives a most intense flame; in fact, the advantage of a blowpipe consists in its burning as much gas as possible in an exceedingly small flame of great intensity. Now, if you will watch me carefully, I will direct the flame on this ball of fine scraps of wrought iron, a metal which is practically infusible in an ordinary furnace, and without turning off the gas I will pinch the gas-supply pipe so as to extinguish the flame. The gas is still there, burning as before, but burning entirely without flame, and, as you see, the iron melts and runs like water instantly. That there is no flame I will prove to you by putting a slip of paper before the blowpipe, which, as you see, is not burned nor discolored; that the gas is burning and has not been interfered with I will prove by stopping the blower, and allowing the gas to burn with a flame as at first. I have now taken you from a cold flame, into the center of which I put my fingers, to an intense heat without any flame, and, as you see, the heat increases as the flame reduces, until at its maximum the flame disappears altogether. The combustion of gases appears to be a succession of explosions, either so quick as to be silent to human ears, or so slow as to make, if continued, a musical sound. To enable you all to hear this I shall, as you will no doubt admit, pass the bounds of what may be considered classical music, but I will make these two burners speak in their own natural tones. If they are not charming as musical instruments they have the one great advantage that a little of it goes a very long way, and you will not desire that my musical performance shall be a long one. The quantity is amply compensated for by the quality, which is certainly not excelled by anything from a donkey to a fog-horn. Bear in mind that the application of gas to music is in its infancy, and there is certainly room for improvement in the future."

American Granulated Sugar.

Our English friends are again disturbed over the introduction of another American product into their dominions. It is not our machinery, hardware, butter, or cheese this time, but it is the introduction into the large English ports of American refined sugars that the British press calls the attention of their refiners to. We extract from an editorial in the *Grocer* (London) of June 14:

"At a time when the British refiners are sorely beset, if not overpowered, with foreign competition from beet sugar manufacturers on the Continent, they are exposed to another menace to their industrial well being by the energy with which their American rivals are now sending granulated sugar over to this country. For some years past there has been what is called a quiet, steady trade doing in the article at intervals, but without arresting much attention or assuming dimensions that were calculated to arouse any jealousy or fear as to its ultimate effects upon the refining industry here. Not only this; the prices at which sales have been made have often been as secret as the contents of a sealed letter of instructions between one military or naval station and another, though when quotations by the merest chance have oozed out, they have generally been found to agree pretty closely with the relative value known to have been current for similar descriptions of English, French, Dutch, or German refines.

"The American sugar refiners, as a rule, do not aim at turning out many specialties of production for the foreign markets, but confin e their operations to the preparation of such kinds as are likely to command the greatest favor at certain periods. The Yankee refiners evidently do not believe in indiscriminate and haphazard competition in the same sense that French and other refined sugar producers do when the latter set their minds upon overrunning the British markets with a glut of inferior goods at random prices, regardless of prime cost—probably because the American conditions of manufacture and export are not exactly the same as those on the Continent, where the system of bounties flourishes in its full blown ugliness; and this modification and changeableness of their policy in supplying our markets accounts for the fits and starts with which sugar is shipped across the Atlantic from the United States.

"Sometimes the sugar the Americans send us takes the form of cubes; at others, that of powdered or granulated sorts; but they never supply us with baked or stoved kinds, nor anything in the shape of pieces or moist goods, more especially as the last mentioned sugars would woefully deteriorate on the voyage hither. They rather make wise selections of what qualities will find the readiest buyers and fetch the best prices. Their plans vary accordingly, and when an article ceases to pay they discontinue working it, or take up with another instead; and if neither of these courses satisfies them, they stop the outturn altogether. If we mistake not, the last time American sugar was sold in any quantity here was in 1879 and 1880, and what are styled 'cubes' were the favorite sugars then.

"This is not the least surprising when it is considered that the American products are derived exclusively from the sugar cane, while those from the Continental refineries, without exception, are manufactured (and that, by the bye, not without a little doctoring and chemical dressing) entirely from beet or mangold-wurzel, which is naturally deficient in both saccharine richness and sweetening power. Any persons accustomed to beet flavored productions are hardly aware of the difference that exists between those and sugars expressed from the cane, and once give them a fair chance of comparing the taste of one with the other, they would never leave cane to return to beet. Thus it is that American made sugars whenever they appear in the English markets nearly always meet with a good reception; and although it is the granulated sort, and not cubes, that is now offering in such large quantities, the preference it gains over other competing qualities is none the less striking and significant. The low price at which it can be bought is likewise greatly in its favor, and ought to insure for it a continued ready sale. As noted, the quotation in April last was 25s. 6d., landed; but through the severe and prolonged depression that has since prevailed, the selling value, in sympathy with that for sugar in general, has recently dropped to 19s. 6d. and 19s. per cwt., cost, freight, and insurance, in barrels of three cwt. each, and the article is passing more freely into consumption than before. The arrivals of American sugar into the United Kingdom this year have been about double those in 1883, and the greater part of the supply goes into Liverpool and the Clyde ports, as being in most direct communication with New York, Boston, and the north of America, from whence it is shipped."

Trial of the Kunstadter Screw.

The experiments with the United States steamer Nina, to which the Kunstadter screw has been attached, were completed July 9, at Newport, R. I., by two trials that proved to Capt. F. McGrau, the President, and all the other members of the Naval Board, the value of the invention. The first trial was from full speed ahead to full speed astern, with helm hard a-starboard to change direction of ship's head eight points. When the signal was given to reverse, the time occupied in getting at full speed astern was 2 minutes 59½ seconds, against 6 minutes 5 seconds without the Kunstadter screw. The second trial was from full speed ahead to full speed astern, with helm hard-a-port to change the direction of ship's head eight points. The time occupied with the screw was 4 minutes 43 seconds; without the screw, 5 minutes 48 seconds. The Board will report to the Secretary of the Navy that the vessel can be more easily steered and maneuvered with the screw than with the ordinary apparatus, and that the tendency will be to decrease the number of collisions.

The Kunstadter screw is an English invention, patented here in 1879. There is a main screw, shaft, and rudder of the usual construction. The rear extremity of the main shaft is elongated, and extends through and abaft the rudder, said elongation at the rudder hinge being swivel jointed to the main shaft. The extremity of the elongation back of the rudder is provided with a small propeller. When the main shaft revolves both propellers revolve, and any lateral movement given to the rudder also laterally moves the small propeller, which thus powerfully assists in turning the ship.

Heart Beats.

Dr. N. B. Richardson, of London, the noted physician, says he was recently able to convey a considerable amount of conviction to an intelligent scholar by a simple experiment. The scholar was singing the praises of the "ruddy bumper," and saying he could not get through the day without it, when Dr. Richardson said to him:

"Will you be good enough to feel my pulse as I stand here?"

He did so. I said, "Count it carefully; what does it say?"

"Your pulse says seventy-four."

I then sat down in a chair and asked him to count it again. He did so, and said, "Your pulse has gone down to seventy."

I then lay down on the lounge, and said:

"Will you take it again?"

He replied, "Why, it is only sixty-four; what an extraordinary thing!"

I then said, "When you lie down at night, that is the way nature gives your heart rest. You know nothing about it, but that beating organ is resting to that extent; and if you reckon it up it is a great deal of rest, because in lying down the heart is doing ten strokes less a minute. Multiply that by 60, and it is 600; multiply it by 8 hours, and within a fraction it is 5,000 strokes different; and as the heart is throwing 6 ounces of blood at every stroke, it makes a difference of 30,000 ounces of lifting during the night.

"When I lie down at night without any alcohol, that is the rest my heart gets. But when you take your wine or grog you do not allow that rest, for the influence of alcohol is to increase the number of strokes, and instead of getting this rest you put on something like 15,000 extra strokes, and the result is you rise up very seedy and unfit for the next day's work till you have taken a little more of the 'ruddy bumper,' which you say is the soul of man below."