B. C. TILGHMAN & J. E. MATHEWSON.

ART OF SHARPENING FILES AND OTHER SIMILARLY TOOTHED TOOLS.

No. 252,979. Patented Jan. 31, 1882.

Fig. 1

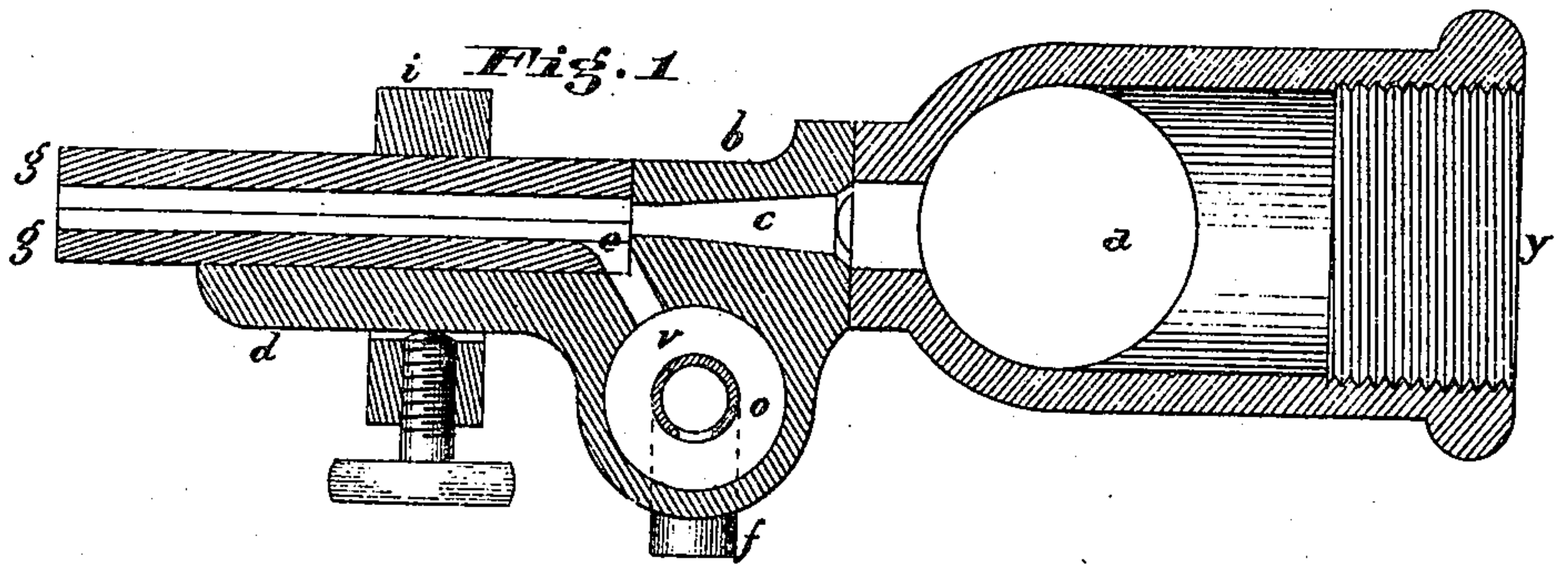

Fig. 3

Fig. 2

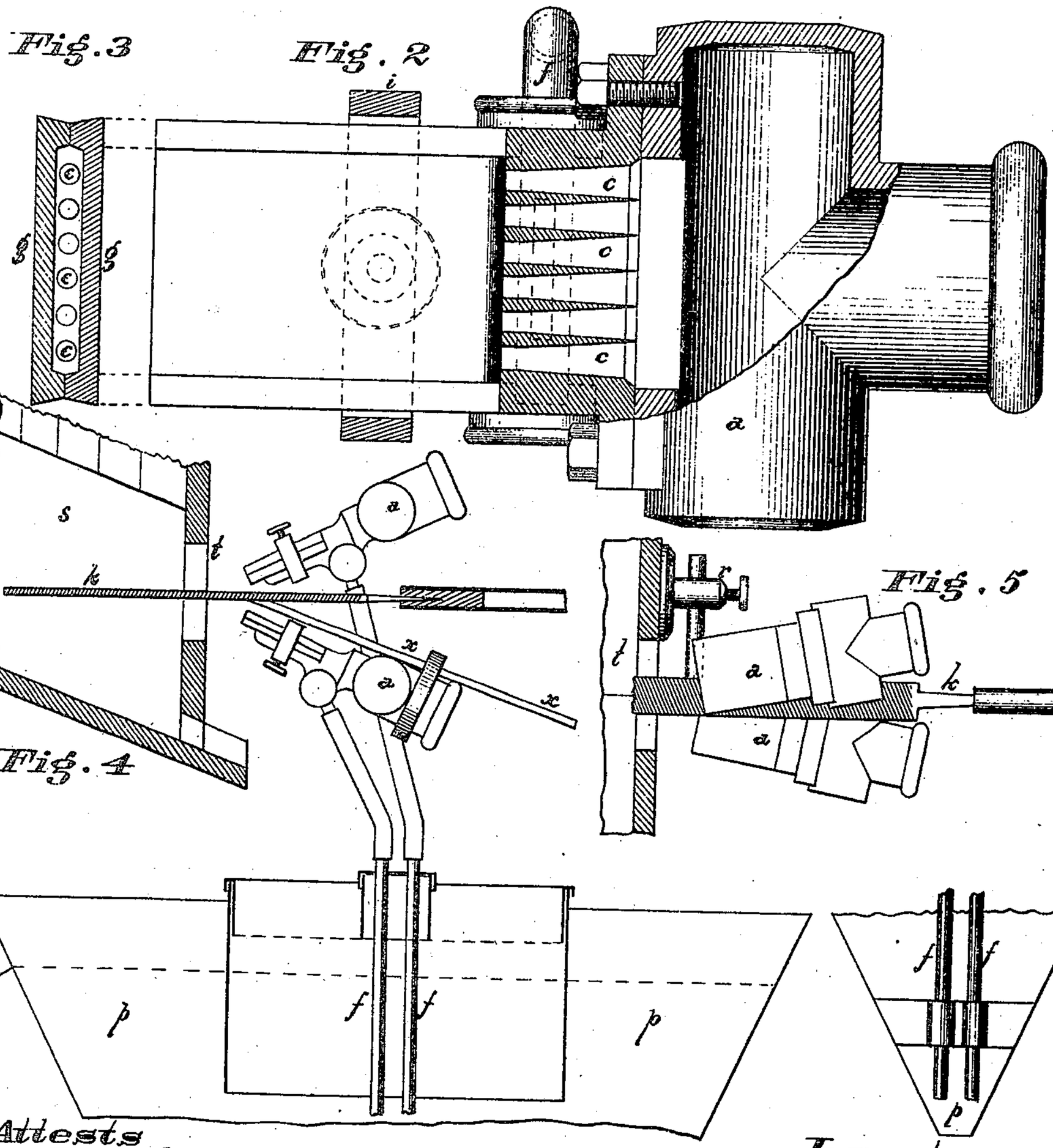

Fig. 4

Fig. 5

Attests

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ART OF SHARPENING FILES AND OTHER SIMILARLY-TOOTHED TOOLS.

SPECIFICATION forming part of Letters Patent No. 252,979, dated January 31, 1882.

Application filed May 12, 1879.

To all whom it may concern:

Be it known that we, BENJAMIN CHEW TILGHMAN, of Philadelphia, Pennsylvania, and JEREMIAH EUGENE MATHEWSON, of the same place, have invented certain Improvements in the Art of Sharpening Files, Rasps, Saws, and similar toothed tools, either straight or circular, by the sand-blast; and we do hereby declare that the following is a full and exact description thereof.

Our invention relates to the sharpening of files, rasps, and similar toothed tools by the sand-blast, as described in the patent of Milo A. Richardson, dated January 22, 1878, No. 199,573, and in the patent of said B. C. Tilghman, dated October 18, 1870, No. 108,408.

Herein we will call the stream of sand impelled by the jet of steam, air, &c., the "sand-blast," and the system of tubes used to produce it the "blast-pipe."

Heretofore in sharpening files, &c., the sand-blast has been applied in a round stream produced by a blast-pipe composed of two concentric tubes, the inner tube supplying the sand, while the steam was supplied by the annular aperture between the two tubes, in the manner described in said Tilghman's Patent No. 108,408. The files have been moved lengthwise under the sand-blast, and when they are wider than the sand-blast a lateral motion is also given, so as to expose all parts in succession to the action. These movements have been given sometimes by hand, sometimes by suitable machinery.

In practice there are certain inconveniences in the above methods. As the sand employed is of such very fine grain that it would not run equably in a dry state, it is generally used mixed with water, in the state of a fluid mud. This mud moves so sluggishly under the influence of the suction or partial vacuum produced by the steam-jet that a central tube of any convenient size, such as would be ample for the supply of dry sand, will not supply a sufficient quantity of the fluid mud. We have found that it is an improvement to supply the steam in the center and the fluid mud outside, and that in this way a larger proportion of sand to steam can be used, and the grinding or sharpening action of the sand-blast is thus made more rapid and efficient than when the fluid mud is supplied in the center and the steam outside.

We should remark that there is an objection to increasing the diameter of the tubes forming a round sand-blast to be used in sharpening files, because, as the sand-blast is applied at an acute angle with the surface, the steam and sand which strike the part of the file nearest to the nozzle-tube are glanced off, and must necessarily pass through and to some extent interfere with the steam and sand which strike the file farther off. The greater the diameter of the round stream the greater will be this interfering action of one portion of the sand-blast with another. Also, when a file is held and moved by hand under a round sand-blast it is difficult to regulate the lateral motion so as to produce an equal effect upon all parts. In operating on the wide face of a flat-file, as soon as the edge of the face is brought under the blast the force acts upon the vertical side of the file and tends to shove it suddenly sidewise, away from and out of the blast; and the result is that it is likely to receive too much grinding in the center of the flat faces, and not enough at the edges, and its surface is apt to become somewhat hollow, which makes it work badly. If the movements of the file under the sand-blast are suitably regulated by machinery, these difficulties may to some extent be avoided, but other inconveniences are then incurred.

We have found that it is an improvement to use a sand-blast which is wide in the direction of the width of the file and thin in the direction of the length of the file, and that in this way the whole width of a file can be acted upon simultaneously and in a more equable manner, and without the necessity of lateral motion, and also that the interfering action above referred to is much less.

In our improved wide and thin sand-blast we have sometimes introduced the steam by one or more thin openings situated in the same plane and the fluid mud by another wide and thin parallel opening; but we prefer to introduce the steam by a number of small round holes placed in a row side by side a little distance apart, so that the fluid mud, though it may be introduced only from one side, is drawn

in by the suction between and around the separate jets of steam, all of which blow into the same nozzle-tube of a suitable wide and thin aperture or cross-section corresponding to the size and number of the steam-holes. The sand or fluid mud thus gets more evenly distributed and better mixed with the propelling-steam. By increasing the number of the steam-holes placed side by side we can make this compound or multi-holed blast-pipe of any desired width, so as to operate at once on the entire width of the widest file, while the sand-blast still remains thin in the direction of the length of the file.

It should be observed that a stream of sand impelled by a single round jet of steam, and striking at an acute angle on the flat surface of the file, must naturally tend to produce a rounded groove. By our improvement of a number of small steam-holes in a row, sucking the sand between them and blowing it into the same wide and flat nozzle-tube, the separate streams diverge sidewise into each other and form one wide and thin sand-blast, which has much less tendency to make the surface of the file hollow or concave.

The kind of file most in use is of a flat shape, with teeth on one or both of its narrow sides.

Heretofore it has been the practice to use at the same time two blast-pipes, one pointing upward and the other downward, at the proper angles in the same vertical plane, so that by moving the file horizontally lengthwise and sidewise between these blast-pipes its two opposite surfaces are acted upon simultaneously, and afterward the other two surfaces are operated on in like manner. It thus took nearly as long to sharpen the two narrow sides as the two wide ones.

We have found that it is an improvement to use thin sand-blasts considerably wider than the files treated, and to arrange two of them so that the upper one inclines downward and to one side, (say to the left,) while the lower one inclines upward and to the other side, (say to the right,) and to cause the file to be moved horizontally lengthwise between them, so as to present its opposite sides at equal angles to the two sand-blasts, and that in this way all the four sides of the file may be sharpened simultaneously.

We find it convenient to make the sand-blasts each about one-half to three-fourths of an inch wider than the file, and to give to the upper one an inclination downward of about twenty-five degrees, and an inclination to the left of about eleven degrees, and to give to the lower one inclinations at similar angles upward and to the right.

The distance between the ends of the nozzle-tubes will depend on the thickness of the files treated; for files about three-eighths of an inch thick about one and a quarter inch from center to center of the ends of the nozzle-tubes is convenient. Even when round sand-blasts are used it is an improvement to direct them at an angle sidewise to the longitudinal axis of the file, instead of parallel thereto, as has been the practice hitherto. There is less tendency to hollow the surface and greater equality of action.

As files of different fineness of teeth and different degrees of dullness ought to receive corresponding degrees of grinding, and as any excess beyond what is necessary is a waste, not only of time and power, but also of the teeth of the file and its capacity of being frequently resharpened, it is very desirable that the workman should possess some means of knowing accurately at each instant of the operation the effect produced on the file, and also the condition of every part of its surface, so that he can expose it to the sand-blast at the proper places and for the proper time. Our improved device for this purpose is to use a bar of metal, (generally gun-metal,) which we will call herein the "feeler." When the working is done by hand this is secured to one of the blast-pipes in such a manner that as the workman moves the file under the blast he can keep it slightly pressed against the feeler. At first, while the file is dull, it slides easily on the feeler, but as the sharpening progresses the workman perceives that it begins to bite more and more, and by thus testing its whole length and each side he can judge when it is well sharpened in all parts.

The nozzle-tube, in which the sand becomes mixed with the steam and gains velocity from it, is the part of the apparatus which wears out most rapidly, and it is desirable that it should be cheap and easily renewable. The best material is white cast-iron; but it is difficult to make a sound casting of a tube having an aperture only about three-sixteenths of an inch wide, such as is suitable for our wide and thin sand-blasts. We cast the nozzle-tube in two separate pieces or half-tubes, which, when put together, form a tube, and are held together and in place by a clamp, the joints being made tight with red lead or putty.

For good working it is desirable that the supply of fluid mud should be of about a uniform degree of thickness or proportion of solid matter. In an ordinary tube or box the tendency of the solid matter to settle to the bottom is apt to cause irregularity, unless the mixture is frequently stirred. Our improvement is to make the mud-vessel of the shape of a cone standing on its point, and to draw the supply of mud from its bottom. As the horizontal area of this vessel decreases toward the bottom the current is proportionately more rapid, and we find that the supply of mud is thus made more regular and the suction-tubes are less apt to become choked, since the mud is always drawn from the point where it is thickest and no sedimentary deposit can have time to form, and thereby alter the rate of cutting of the apparatus.

The following is a description of the apparatus which we prefer to use in order to carry

out our improvements, reference being had to the drawings.

Figure 1 shows in full size a vertical section of a multi-holed blast-pipe. Fig. 2 is a horizontal section thereof, the same letters referring to similar parts.

a is a casting of gun-metal intended to be screwed onto a steam-valve supplying steam of about sixty pounds pressure per square inch.

b is a separate piece of gun-metal, which is to be fastened by screws to *a*, the joint being made tight by solder or otherwise. In *b* are bored the steam-holes *c c*, about one-fourth of an inch apart from center to center, and about sixteen one-hundredths ($\frac{16}{100}$) of an inch in diameter at their front or small end, and continuing of this diameter backward for about one-sixth of an inch, and then widening conically until their edges meet. The central lines of these steam-holes should be parallel to the central line of the screw *y*. The projecting part *d* of the piece *b* has its upper surface made parallel with the axes of the holes *c c*.

g g is the nozzle-tube, made preferably of very hard cast-iron. It is made in two pieces, which, when put together, form a flat tube about two and a half inches long, and having a wide and thin aperture, the cross-section of which is about three-sixteenths ($\frac{3}{16}$) of an inch high, and about one-quarter of an inch wider than the row of steam-holes. The nozzle-tube *g g* is held together and also fastened to the piece *b d* by the clamp *i*. When necessary, packing-pieces of thin metal or paper are inserted between the nozzle-tube and the piece *d*, so as to insure that the central plane of the nozzle-tube shall coincide with the central lines of the steam-holes *c c*. This adjustment is important, if it is not accurate the sand-blast will strike too much upon either the upper or lower side of the nozzle-tube and will soon cut it away.

In order to admit the supply of fluid mud, the lower half of the nozzle-tube *g g* is cut away for about one-eighth of an inch at its inner end, *e*, and a corresponding aperture, *v*, is made in the piece *d*, so as to communicate with the cross-tube *o* and the vertical pipe *f*, which descends to the bottom of the conical mud-vessel *p*, Fig. 4. The metal of the piece *b d* is also sloped off below the row of steam-holes, so as to facilitate the entrance of the fluid mud from the tube *o* into the nozzle-tube. All the joints between and around the nozzle-tube are made air-tight with red lead or putty.

Fig. 3 shows in cross-section and full size the two pieces composing the nozzle-tube *g g*, and also shows the steam-holes *c c*, as seen by looking into the end of the nozzle-tube.

Fig. 4 shows in quarter-size the method of mounting the apparatus for use.

s is the settling-chamber in which the fluid mud is collected after being used. It consists of a wooden box about six feet cube, having a sloping water-tight bottom with a gutter in the middle.

t is the working-hole, about four inches long by two and a half inches high, in the front of the chamber *s*. The two converging blast-pipes *a a* drive through this hole into the chamber *s* the streams of fluid mud and steam, together with a current of air. The mud and water fall to the bottom and return by the gutter to the conical mud-vessel *p*, from which it is again sucked up by the tubes *f f* into the blast-pipes and reused. The waste steam and air escape to a chimney by a hole about one foot square in the top of the chamber *s*.

x x, Fig. 4, show the feeler, which is generally a bar of gun-metal about one and a quarter inch wide, one-quarter of an inch thick, and of any convenient length. It is fastened on top of the lower blast-pipe and projects beyond the end of the nozzle-tube, so that when a file, *k*, is laid horizontally upon the projecting end of the feeler the opposite surfaces of the file will be at about equal distances and angles from the ends of the two nozzle-tubes. As the projecting end of the feeler gets worn away by the rubbing of the file it is pushed forward.

The sand used in the state of fluid mud to feed the blast-pipes is about as fine as flour-emery. To make up the waste, a supply of sand fine enough to pass through a sieve of one hundred and twenty wires to an inch is put into a hopper at the back end of the floor of the chamber *s*, and gets gradually washed down into the mud-vessel.

The conical mud-vessel *p* is made of sheet metal, about two feet high and two feet in diameter at the top. In the center of its cover is a movable sieve, ten inches in diameter and about fourteen wires to the inch, to catch any dirt. In the middle of the sieve is a tubulated opening, through which the suction-tubes *f f* pass and plunge to the bottom of the cone. Before being exposed to the sand-blast the files should be cleaned by boiling in caustic alkali, and any pins or choaks of metal between the teeth should be removed. The steam should be dry and free from water.

The way of working is as follows: The files are put in handles about thirty inches long, made of pieces of iron tube plugged at the ends with wood. The conical mud-vessel is filled with fluid mud made about as thick as will flow freely through a tube of three-eighths of an inch in bore. The steam is immediately turned on, and the fluid mud is sucked into the two blast-pipes *a a*, Fig. 4, and projected in two converging streams through the working-hole *t* into the chamber *s*. The workman lays the file *k* horizontally on the upper end of the feeler *x x*, and draws it slowly and regularly back and forward its whole length between the two sand-blasts, taking care to keep it level and straight between them, and turning it occasionally so as to test both sides on the feeler, until he finds that it is well sharpened in every part.

In order to have some lateral guide, it is convenient to adjust in front of the working-hole, about midway between the ends of the

nozzle-tubes, a piece of smooth hard steel, *r*, Fig. 5, in such a position that the workman can lightly touch it with the side of the file in its back and forward movements. The time required depends on the size of the file, the coarseness of its teeth, and their state of dullness, and the workman is guided by the gradual improvement of the bite on the feeler. From this he also learns to judge whether the apparatus is working well, and whether the sand is of a proper fineness. Beyond a certain degree of fineness the sand does not cut so rapidly, though it will in time produce a smooth and keen edge. Coarse sand cuts rapidly, but makes a more rough and blunt edge. Under good conditions a twelve inch flat bastard file which has been fairly worn out by a fitter, but has not been used to clean castings, can be sharpened in about one to one and a half minute. The excess of water, carrying with it some of the finest mud, overflows from the mud-vessel into another box, where its solid matter settles.

Fig. 5 shows the sidewise inclination of the blast-pipes to the longitudinal axis of the file, and also the lateral guide *r*.

We hereby disclaim anything that is described in the patent granted to B. C. Tilghman, dated October 18, 1870, No. 108,408; or in the patent granted to Milo A. Richardson, dated January 22, 1878, No. 199,573; or in the English patent granted to J. E. Mathewson, No. 1,584 of 1877.

What we claim as our invention, in sharpening files, rasps, and similar toothed tools by the sand blast, is—

1. In the method of sharpening files described, the employment of one or more interior steam-jets, combined with an exterior supply of fluid mud or fine sand mixed with water, applied to the sharpening of files, substantially as described.

2. In an apparatus for producing a wide and thin sand-blast, one or more thin apertures in the same plane, or preferably a row of small holes having intervals between them for introducing the steam.

3. The improved method of sharpening the teeth of files, wherein the formation of grooves is avoided, by presenting the sand-blast at an acute angle sidewise to the longitudinal axis of the file, and at the same time at an acute angle to the horizontal plane of the teeth thereof, substantially as specified.

4. In sharpening files by the sand-blast, the method of sharpening two adjacent sides simultaneously, which consists in presenting the file to a thin sand-blast of a width greater than that of the file and at the angle, substantially as described.

5. A feeler to test the progress of the sharpening during the operation.

6. The combination of a conical mud-vessel with the suction-pipe of a sand-blast apparatus.

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J. E. MATHEWSON.

Witnesses:
J. K. KILBOURN,
WALTER CLARK.