May 2, 1933. E. M. AITKEN 1,907,196

FILE SHARPENING METHOD AND APPARATUS

Filed Oct. 20, 1930 3 Sheets-Sheet 1

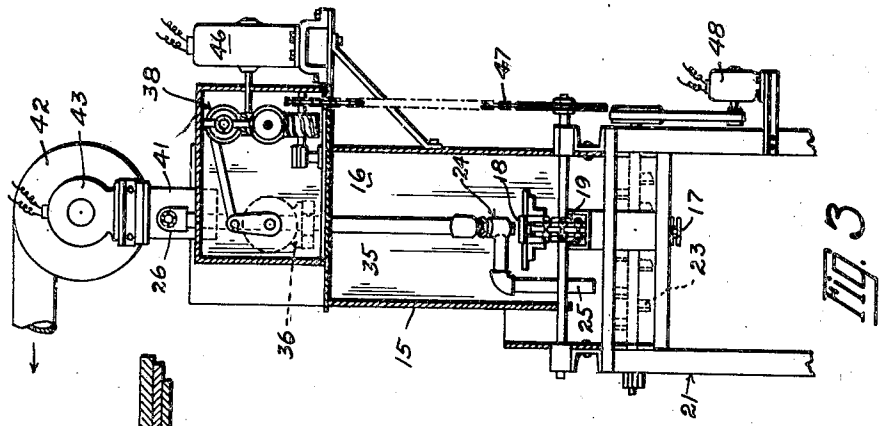


Fig. 3

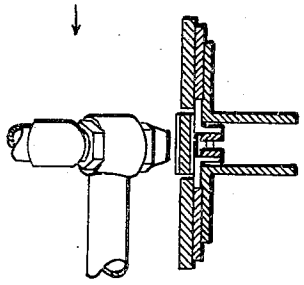


Fig. 4

Fig. 1

Fig. 2

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FILE SHARPENING METHOD AND APPARATUS

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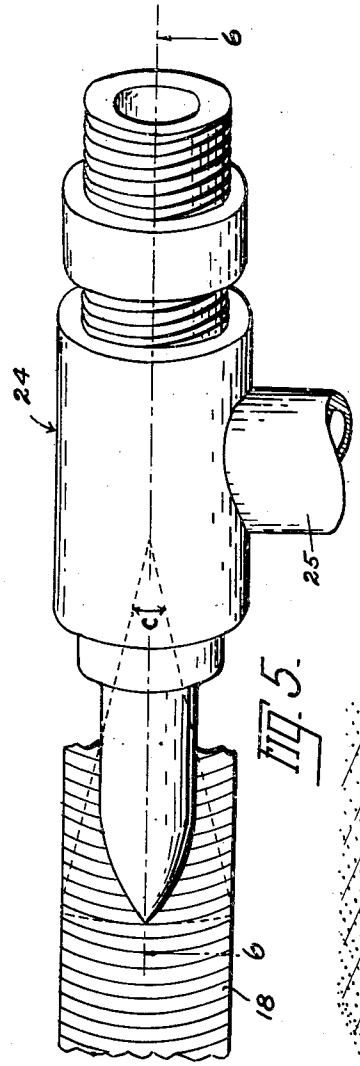


FIG. 5.

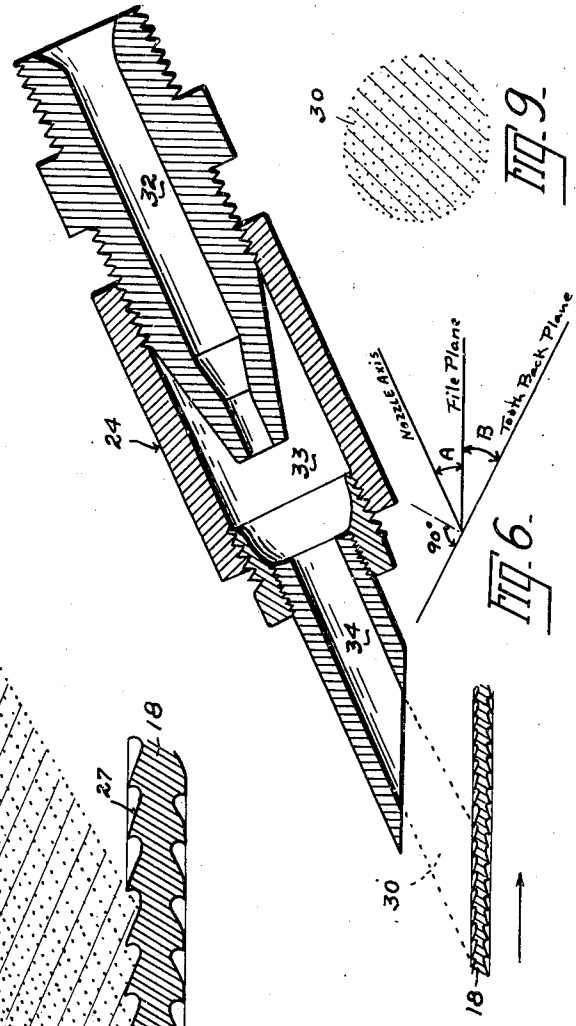


FIG. 6.

FIG. 9.

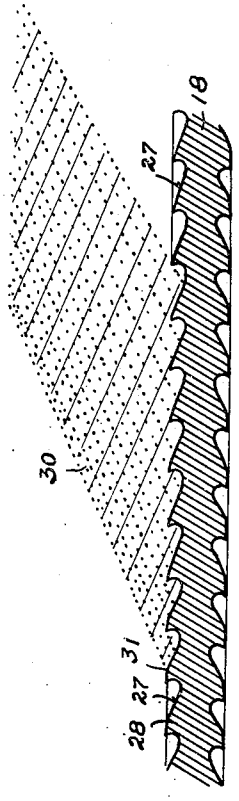


FIG. 7.

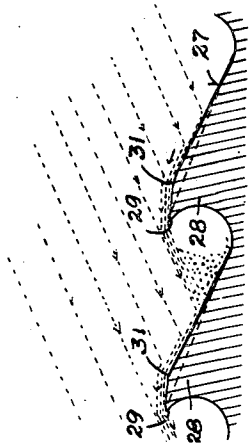


FIG. 8.

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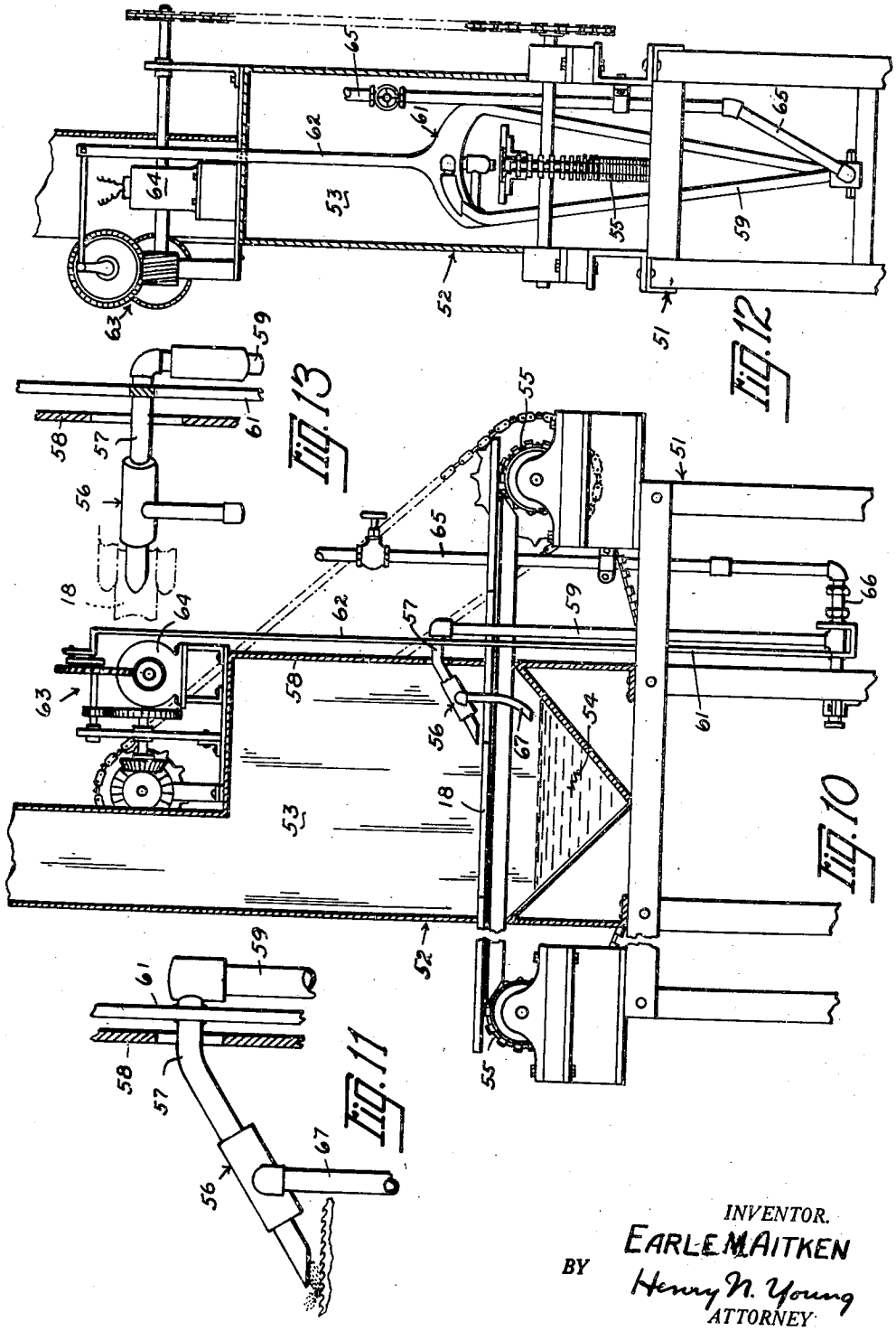


Fig. 12

Fig. 13

Fig. 10

Fig. 11

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UNITED STATES PATENT OFFICE

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FILE SHARPENING METHOD AND APPARATUS

REISSUED

Application filed October 20, 1930. Serial No. 489,786.

The invention relates to a device for sharpening files, both new and used.

An object of the invention is to provide a continuously operable method for sharpening files and the like by use of a sand blast.

Another object of the invention is to provide a file sharpening device wherein the cutting edges of a file are formed or restored with a minimum erosion of material thereat.

A further object of the invention is to provide for a uniform and continuous application of the sand blast for assuring uniform results in the use of the device.

Yet another object is to provide a file sharpening method wherein the sharpening process occurs mainly at the outer tooth surfaces.

An added object is to provide generally improved and simplified apparatus for applying a sand blast as a file sharpening means.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth or be apparent in the following description of preferred embodiments of the device, and in the accompanying drawings in which:

Figure 1 is a somewhat diagrammatic side elevation of apparatus embodying the invention, a casing of the apparatus being broken away to disclose certain interior mechanism of the structure.

Figure 2 is an enlarged fragmentary elevation of a sand-blast nozzle shown in Figure 1.

Figure 3 is an end and partly sectional view of the apparatus shown in Figure 1.

Figure 4 is an enlarged rearward view of the aforesaid nozzle structure.

Figure 5 is a still further enlarged and plan view of the nozzle structure.

Figure 6 is a section at 6—6 in Figure 5, angular relations of the nozzle to a file being diagrammatically illustrated in connection with the view.

Figure 7 is an enlarged section through a file and the sand blast thereat.

Figure 8 is a diagrammatic view illustrating the approximate action of the sand blast against a file tooth.

Figure 9 represents a cross-section through the sand blast stream for showing the distribution of abrasive particles therein.

Figure 10 is a view corresponding to Figure 1 and disclosing a modification of the apparatus.

Figure 11 is an enlarged side elevation of the nozzle arrangement of the embodiment of Figure 10.

Figure 12 is an end view of the structure of Figure 10, portions of the structure being broken away.

Figure 13 is an enlarged plan view of the nozzle structure of the modification of Figures 10 to 12.

Essentially, the present invention involves a method for utilizing a sand blast for sharpening or resharpening a toothed tool such as a file, said method comprising the directing of a sand blast against the tool teeth in such a manner as to primarily erode the tooth backs for producing or restoring the cutting edges of the teeth. The disclosed apparatus for carrying out the aforesaid method is arranged for a passing of files through the blast at a constant speed and in such relation to the blast that said apparatus may operate continuously.

As particularly disclosed in Figures 1 to 9 inclusive, the apparatus for carrying out the present invention essentially comprises a casing 15 providing a working chamber 16 through which a chain conveyor 17 is arranged to carry a succession of files 18 placed end to end on the conveyor. The conveyor 17 is carried by and between sprockets 19 mounted at opposite ends of a frame 21, said frame carrying the casing 15 intermediate the ends thereof. The bottom of the casing 15 is formed to provide a sump or reservoir for a fluid abradant, the latter comprising an aqueous mixture 22 containing a comminuted abrasive material, and, if desired, bentonite or some other material for maintaining the suspended condition of the abrasive particles in the mix. As shown, a power-driven stirrer 23 is operative in the reservoir portion of the casing 15.

Mounted above the conveyor and within the chamber 16 is a sand blast nozzle 24, said nozzle being of an injector type whereby a

gaseous stream therethrough is arranged to draw the mixture 22 thereinto through a lift pipe 25 depending into the mixture in the sump from the mixing chamber of the nozzle. Preferably, the driving fluid for the sand blast stream is steam, and the nozzle 24 is accordingly connected with a steam supply pipe 26. The nozzle structure is particularly brought out in Figures 2, 5 and 6, and will be hereinafter described in greater detail.

Examination of a worn file discloses that the wear thereon has more or less rounded the backs of the teeth whereby the same tend to ride over the work and the cutting edges of the teeth may not bite. This condition is particularly brought out in the showings of Figures 7 and 8 wherein are found magnified views showing the application of the sand blast to a file in accordance with the present invention. In Figure 7, a double-faced file is shown in section, said file having worn teeth on its under side and having its upper side teeth in various stages of repair depending on their relation to a sand blast stream directed against the latter file side. By reference to said figures, it is seen that the abrasive stream 30 strikes the back faces 27 of the file teeth 28 at such an angle that the stream particles are deflected outwardly along said faces for eroding the same. Those particles which have struck a tooth nearest its base are held against the face 27 thereof by the impact of the stream itself whereby the deflected particles move along and operate against the face 27 for its entire area adjacent the tooth edge 29. The inertia of the deflected and working stream carries it sufficiently beyond the edge 29 that said edge is abraded only from the outer face portion thereat whereby the ultimate wearing away of the back hump 31 of the tooth results in the restoration of the operativeness of the working edge with substantially the same working angle as was originally provided thereat.

Preferably, the blast is arranged to strike a number of teeth at once and the file is moved longitudinally through the blast in the opposite direction to a working traverse of the file, as is particularly shown. The aforesaid resharpening of the file teeth is understood to be largely dependent on a correct angular relation of the blast axis to the planes of the tooth backs. As particularly illustrated in Figure 6, the angle between the nozzle axis and the back planes of the teeth approximates fifty degrees, with the acute angle A defined between the nozzle axis and file plane approximating twenty-five degrees, and the acute angle B defined between the file plane and the tooth back planes of substantially the same size as the angle A. In this manner, the angle of incidence of the sand blast to the tooth backs is understood to approximate forty degrees.

Means are provided whereby a graduated blast action is provided as a tooth moves through the blast zone; as particularly shown, said means comprises a novel construction of the nozzle 24 whereby the sand blast stream 30 emitted thereby is of varying density and velocity in a cross-section thereof, the stream density and velocity both being least at the side of the stream through which the ground teeth last move. As shown in Figure 6, the axis of the steam inlet passage 32 to the mixing chamber 33 of the nozzle structure is parallel to and laterally offset from the axis of the nozzle discharge passage 34 whereby a blast stream of the desired structure is provided.

The nozzle 24, it will now be noted, is arranged for oscillation about a vertical axis whereby the blast jet will laterally sweep a file therebeneath as the file is advanced. As particularly illustrated, the nozzle is carried at the lower end of a pipe 35 connecting the nozzle with the steam supply pipe 26, the pipe 35 depending through an upper casing wall and provided externally of the casing with a bevel gear 36. A swivel joint 37 is provided at the juncture of the pipes 26 and 35 whereby to permit an oscillation of the nozzle, it being noted that the axis of swivelling intersects the nozzle 24 intermediately thereof. The pipe 35 and nozzle are arranged to be oscillated by means of a suitable power driven mechanism 38 including gearing and a crank shaft, the angle of oscillation C (Figure 5) being of proper magnitude to insure a complete lateral traverse of the file by the blast jet during each oscillative movement of the nozzle.

A discharge duct 41 leads from the upper casing portion, said duct having a suction fan 42 operative therein for exhausting the working chamber 16 in the casing. An electric motor 43 is shown as provided for operating the fan 42, said fan being operated at a speed to prevent a building up of a positive pressure in the said chamber, An air inlet duct 44 is provided for discharge into the lower casing portion, air entering said duct being preheated by means of a gas burner 45 provided for the purpose. The arrangement now described for circulating gaseous materials through the working chamber is designed to prevent such a condensation of the sand blast steam as will unduly dilute the abrasive mix, just enough condensation taking place to keep said mix of a constant fluidity.

An electric motor 46 is mounted on the casing for oscillating the nozzle through the mechanism 38 and simultaneously actuating the conveyor chain 17 through gearing and a sprocket chain 47. The stirrer 23 is arranged to be driven by still another motor 48.

It will now be noted that the previously described mechanism is particularly shown as

arranged for finishing the resharpening of worn files, and that such files may first be run through a roughing-out machine operating generally similarly to the finishing machine. The latter type of machine is illustrated in Figures 10 to 13 wherein a frame 51 carries a casing 52 defining a working chamber 53 having a sump in its bottom portion for the reception of an aqueous mix 54 of the abradant. A conveyor chain 55 is provided for carrying files horizontally through the casing chamber above the sump portions thereof as in the first-described embodiment. The nozzle 56 of the present embodiment is structurally similar to the nozzle 24 but is differently mounted.

Referring to the disclosed mounting of the nozzle 56, the same is seen to be carried at the end of a steam pipe having a generally horizontal portion 57 extending through an aperture in a casing wall 58 and an upright portion 59 extending downwardly to a point of the frame 51 considerably below the working level of the nozzle. A yoke-like frame 61 is pivotally mounted on the frame externally of the casing and carries the pipes 58 and 59 for effecting an arcuate oscillation of the nozzle 56 laterally across a file on the conveyor chain and in the working chamber 53. The nozzle movement effected is so short and on such a long radius as to be substantially rectilinear. In practice, the operative relation of the conveyor chain and member is such that a file is moved ahead one tooth at each swing of the nozzle. An arm 62 extends upwardly from the frame 61 and is connected by means of a crank and gear mechanism 63 with a motor 64 for effecting the desired rocking of the member and nozzle. A steam supply pipe 65 is connected to the pipe 59 through a swivel joint 66 connecting with tee portion of the pipe 59, said latter pipe portion comprising the shaft which supports the yoke and nozzle assembly.

For roughing-out purposes, the mix 54 is considerably less fluid than the finishing mix 22. Furthermore, in the present apparatus, the suction pipe 67 of the nozzle 56 does not actually extend into the mix in the sump; whereby frictional resistance to the nozzle movement is minimized. To provide for the operation of the suction pipe as indicated, the discharged blast leaving the file is so directed as to agitate the mix 54 in the sump 53 for atomizing the material at its surface whereby the suction pipe receives only atomized abradant from above the surface of the mix in the sump. In using the roughing-out machine, the working angle of the blast jet to the tooth backs is preferably a few degrees greater than that used in the finishing machine whereby some slight preparatory hollow grinding of the tooth is accomplished.

While the present embodiments of the invention are shown as particularly arranged for sharpening or resharpening files of a particular type wherein the teeth are arcuate and each extend entirely across the width of the file, the disclosed apparatus and method have been found equally applicable to the sharpening of files having other forms of teeth, said files being either new or used. For new files, the use of the roughing-out embodiment may be unnecessary.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative, and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States the following:

1. The method of sharpening a file, which comprises directing a sand blast obliquely against the back faces of a plurality of successive file teeth whereby the deflected sand is directed outwardly along said faces and longitudinally of the file, a section of said sand blast being of progressively varying density longitudinally of the file.

2. In file sharpening apparatus, a nozzle for delivering a sand blast against a file for grinding the back surfaces of the file teeth to restore the cutting edges thereof, said nozzle formed to provide a stream of varying density in its section.

3. In file sharpening apparatus, a nozzle for delivering a sand blast stream obliquely against a back surface of a file tooth whereby the deflected sand is directed outwardly along said back surface, said stream of varying density in its section and being of least density at that portion thereof which first strikes the file.

4. In file sharpening apparatus, means providing a sump for an aqueous mixture containing an abradant material, means for delivering a stream to contain said material comprising a body having a mixing chamber, an inlet duct connecting said sump with said chamber, an inspirator nozzle for discharging a gaseous fluid into said chamber whereby to supply said material thereto from said sump by inspiration, and a discharge nozzle for said chamber, the axis of the nozzle passages being mutually parallel and relatively offset whereby the stream discharged from said discharge nozzle is arranged to be of similarly varying density and velocity across its section.

5. The method of sharpening a file, which comprises directing a sand blast obliquely

and progressively against the back faces of successive file teeth whereby the deflected sand is directed outwardly along said faces and longitudinally of the file toward one end thereof, a section of said sand blast being of progressively varying density longitudinally of the file and the relative movement of the file and blast being effected solely in one direction and at an unvarying speed.

In testimony whereof, I affix my signature.

EARLE M. AITKEN.