

United States Patent

Feldcamp

[15] 3,699,725

[45] Oct. 24, 1972

[54] METHOD OF FINISHING AN APERTURE

[72] Inventor: **Edward George Feldcamp**, 60 Robert Burns Avenue, Benhall, England

[22] Filed: **Sept. 17, 1970**

[21] Appl. No.: **73,110**

[30] Foreign Application Priority Data

Sept. 17, 1969 Great Britain.....45,940/69

[52] U.S. Cl.....51/317

[51] Int. Cl. B24b 1/00

[58] Field of Search.....51/2, 7, 317, 305

[56] References Cited

UNITED STATES PATENTS

3,521,412 7/1970 McCarty.....51/317

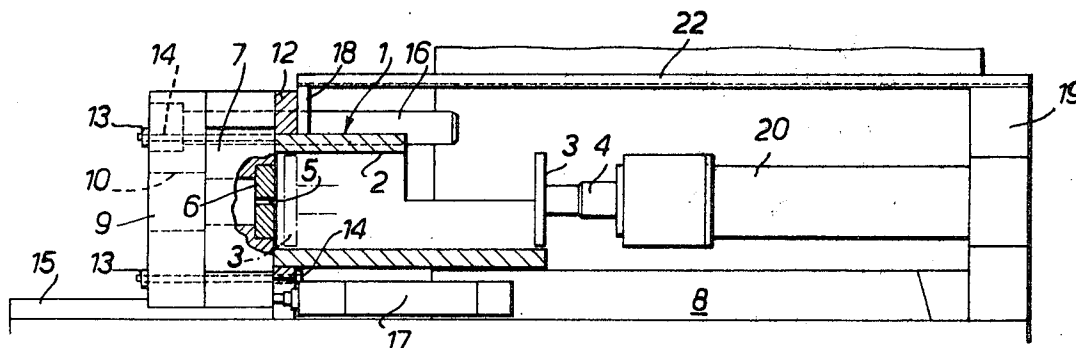
3,039,234 6/1962 Balman.....51/317
2,346,228 4/1944 Merrill et al.....51/317
3,583,103 6/1971 Rystrom.....51/317

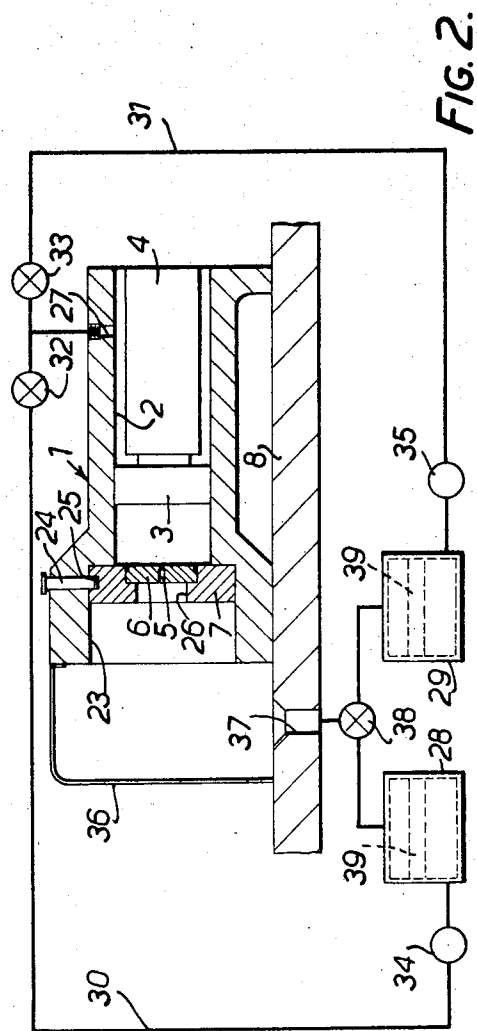
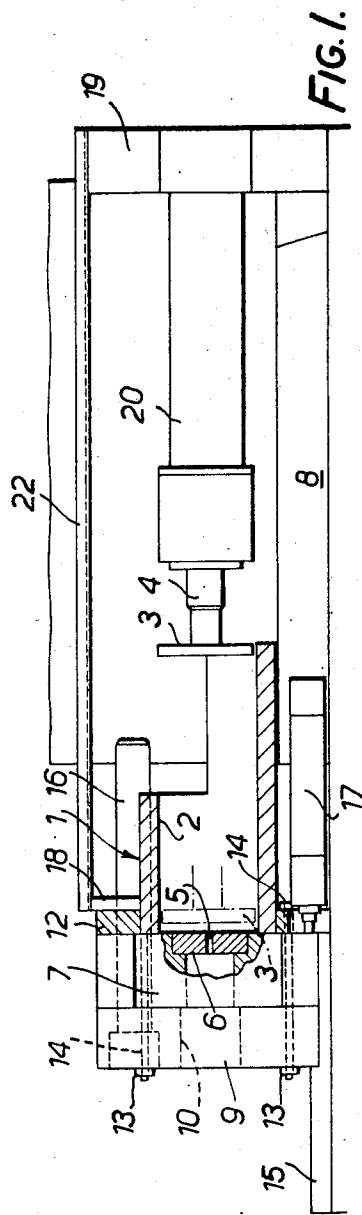
Primary Examiner—Donald G. Kelly
Attorney—Young & Thompson

[57] ABSTRACT

A method of finishing a pre-formed aperture in a metal component, for example an extrusion tool opening, to achieve a desired surface finish for the side wall of the aperture, comprises the step of forcing a wax-like abrasive compound through the aperture. Apparatus performing the method comprises a cylinder at one end of which a tool holder can be mounted. A ram-operated piston is reciprocable in the cylinder to force the abrasive compound through the extrusion tool when mounted in the holder.

7 Claims, 2 Drawing Figures





METHOD OF FINISHING AN APERTURE

This invention relates to a method of finishing a pre-formed aperture in a metal component to achieve a desired surface finish for the side wall of the aperture. It is of particular, but by no means exclusive, application to finishing the opening in an extrusion die or "tool" as used in the extrusion of aluminum sections.

At present an extrusion tool is normally pre-formed using a spark erosion technique, and after heat treatment to provide the appropriate hardness for the extrusion tool the wall of the tool opening is finished by hand using small files and emery cloth to provide a satisfactory surface finish. This removes the "etched" finish left by the spark erosion process, but it requires considerable skill and care if the shape of the opening is to be maintained and the die performance not affected due to an adverse slope being given to the various portions of the side wall. The performance of the finished tool depends upon a uniform speed of metal flow through the opening during extrusion, and the speed of flow at any point is largely determined by the inclination of adjacent portions of the side wall. Thus hand finishing is a skilled process and if badly done can easily result in a tool having to be scrapped, and hence it is essentially slow and expensive in terms of skilled labor.

The object of the invention is to provide a method which will replace the usual hand finishing of the opening in an extrusion tool, providing more uniform and accurate finishing while not requiring the employment of highly skilled labor.

To this end a method of finishing an opening in an extrusion tool, according to the invention, comprises mounting the tool in a holder, and forcing an abrasive compound through the tool. As it passes through the tool opening the compound abrades the side wall, and the abrasion process is continued until the desired finish is achieved.

The abrasive compound may be a liquid, a paste-like or a solid wax suspension of abrasive particles. For example the compound may comprise particles of an abrasive such as silicon carbide in a base of so-called "dental wax," i.e., the wax used to take dental impressions.

It will be appreciated that the abraded finish is uniform around the opening, so that the accuracy of the preformed shape is not affected. The tool holder is desirably positioned at one end of a cylinder containing a ram which forces the abrasive compound through the tool in a manner which simulates the extrusion process, and different grades of abrasive compound may be used to provide successive coarse and fine finishing.

Means for performing the above method comprise a cylinder at one end of which the tool holder is or can be mounted, a ram reciprocable in the cylinder to force the abrasive compound through an extrusion tool mounted in the holder. Means for supplying the abrasive compound to the cylinder may be provided, and such means may include a pump and supply tank when the abrasive compound is of a liquid nature. A variable speed ram is preferably used; for example the speed may be variable over a range of 1 to 10 strokes per minute.

Two embodiments of the invention in the form of methods of finishing the opening of an extrusion tool, and the corresponding method finishing, will now be

described by way of example with reference to the accompanying drawings. In the drawings:

FIG. 1 is a part-sectional side view of one of the embodiments for use with a solid wax base abrasive compound, and

FIG. 2 is a similar view of means of the other embodiment for use with a liquid base abrasive compound and showing diagrammatically means for recirculating the compound.

In each embodiment a cylinder 1 has a longitudinal and horizontal bore 2 within which a piston 3 is reciprocable on the end of a hydraulic ram 4. Thus reciprocation of the ram 4 forces the abrasive compound from the cylinder 1 through the tool opening 5, the tool 6 being held in a tool holder 7 during the finishing operation. The cylinder 1 is secured to a base plate 8.

In the embodiment of FIG. 1 the rear half of the cylinder is cut away above a horizontal diametral plane to provide a loading aperture, into which the abrasive wax compound is loaded with the piston 3 in the retracted position illustrated. The piston 3 is shown at the forward end of its stroke in broken lines, in which position the compound previously loaded has been forced through the tool opening and the piston is ready to commence a return stroke. The tool holder 7 is held in a tool carrier 9 with an end opening 10 through which the compound leaves the tool opening, and the carrier 9 is clamped against an end flange 12 of the cylinder by nuts 13 threaded on to tie rods 14 which pass through the flange 12.

A tool carrier 9 is slidably mounted on two parallel slide bars 15 so that on removal of the nuts 13 it can be moved away from the front end of the cylinder 1 to fit or remove the tool 6 and tool holder 7. A guide rod 16 is provided which projects rearwardly from an upper portion of the tool carrier 9 and is slidably guided through the cylinder flange 12. Movement of the carrier 9, when the nuts 13 are removed, is produced by a hydraulic ram 17.

A frame member 18 is welded to the base plate 8 and the cylinder flange 12, and a spaced frame member 19 supports the casing 20 of the ram 4. The ram 4 is, for example, capable of exerting a maximum pressure of the order of 50 tons, and this is withstood by the base plate 8 below the ram 4 and two angle section tie bars 22 extending between the upper edges of the front members 18 and 19.

In the embodiment of FIG. 2 the cylinder 1 is enlarged and counterbored at its front end at 23 to form a seating for the tool holder 7. The holder 7 is detachably retained in position by suitable means, for example radially displaceable pegs such as 24 which engage circumferential recesses 25 in the holder 7. The holder 7 has a through aperture 26 which is counterbored on its inner rear side to provide a sealing for the tool 6 during finishing.

The ram 4 is, for example, again capable of exerting a maximum pressure of 50 tons at a speed variable between 1 and 10 strokes per minute. An inlet port 27 in the cylinder wall is uncovered when the ram 4 approaches the end of its return stroke. Two supply tanks 28 and 29 respectively contain coarse and fine abrasive compound in the form of a viscous liquid, and these tanks are respectively connected to the inlet port 27

through pipelines 30 and 31 each of which contains a shut off valve 32 or 33 and a pump 34 or 35. Thus either coarse or fine abrasive compound can be supplied to the cylinder 1 when the ram 4 is retracted, and during the next forward stroke of the ram 4 the compound is extruded through the tool opening 5 to finish the side wall of the latter by abrasion. Reciprocation of the ram is continued until the desired surface finish is obtained, the coarse compound being used initially and the final desired finish obtained using the fine compound.

After it has passed through the tool 6 the compound is collected within a hinged hood 36 and returned to the appropriate supply tank through a drain port 37 and two-way changeover valve 38. It is contained and caused to flow to a port 37 by the hood 36 which as shown normally shrouds the front end of the cylinder 1 but which can be lifted up for removal and replacement of the tool holder 7. Each of the tanks 28 and 29 has an internal high level filter 39 which cleans the compound and removes swarf, etc.

It is to be understood that references herein to a "metal extrusion tool" are to be read as referring to extrusion tools formed of metal and not necessarily to tools for the extrusion of metal.

I claim:

1. A method of finishing a pre-formed aperture in a component to achieve a desired surface finish for the side wall of the aperture, comprising the step of forcing through the aperture an abrasive compound compris-

ing abrasive particles distributed in a wax base.

2. A method according to claim 1, wherein the compound comprises a suspension of particles of an abrasive such as silicon carbide in a base of wax of a nature similar to dental wax.

3. A method according to claim 1, wherein said step is one of a plurality of similar steps using different grades of abrasive compound to provide successive coarse and fine finishing.

4. A method according to claim 1 employed for finishing an extrusion tool and wherein the abrasive compound is forced through the tool opening in the intended extrusion direction and in a manner simulating the normal extrusion process.

5. A method according to claim 4, wherein the abrasive compound is forced through the tool by a ram capable of exerting a pressure of the order of 50 tons.

6. A method according to claim 1, wherein the component is mounted in such manner as to provide a free space on the side of the component at which the abrasive compound leaves the opening, in which space the compound leaving the opening is not closely confined.

7. A method of finishing the die opening of an extrusion tool, comprising mounting the tool in a holder and extruding an abrasive compound through the opening under pressure in the intended extrusion direction and in a manner simulating the normal extrusion process, the abrasive compound consisting of abrasive particles distributed in a base of solid wax-like material.

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