United States Patent [19]

Rosenthal

[11] **3,852,176**

[45] **Dec. 3, 1974**

[54] **EMBRITTLEMENT MACHINING METHOD**

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[22] Filed: **Dec. 6, 1972**

[21] Appl. No.: **336,115**

Related U.S. Application Data

[63] Continuation of Ser. No. 117,995, Feb. 23, 1971, abandoned.

[52] **U.S. Cl.** **204/129.46,** 204/129.8

[51] **Int. Cl.** **B23p 1/00**

[58] **Field of Search** 204/140, 224, 129.46, 129.8

[56] **References Cited**

UNITED STATES PATENTS

2,385,198	9/1945	Engle	204/224
3,424,054	1/1969	Cook et al.	204/222
3,565,775	2/1971	Bouchet et al.	204/224
3,672,963	6/1972	DePalma	204/14 N

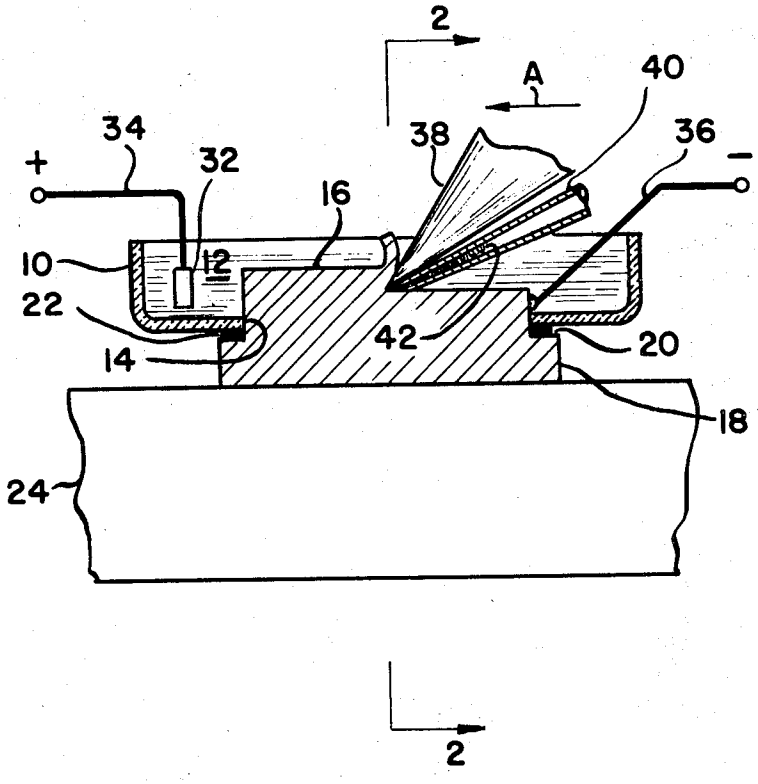
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[57] **ABSTRACT**

Embrittlement machining apppartus having an electrolytic container, an anode, a workpiece immersed in the electrolyte forming a cathode, a cutting head adjacent the workpiece and a conduit for supplying an embrittlement agent adjacent the workpiece and adjacent the cutting head.

2 Claims, 2 Drawing Figures



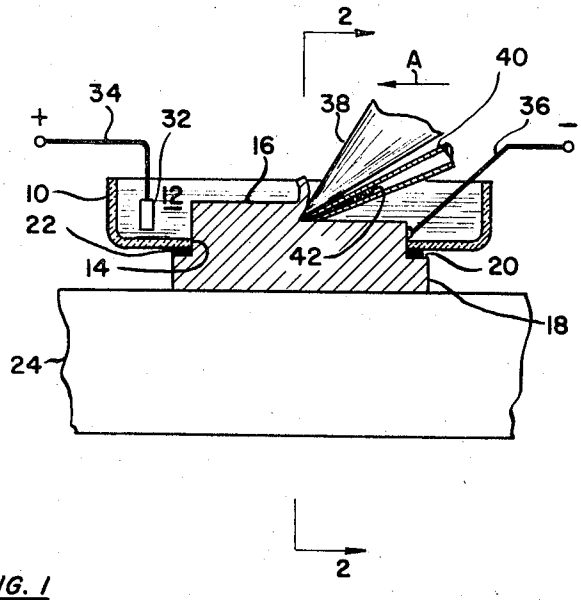


FIG. 1

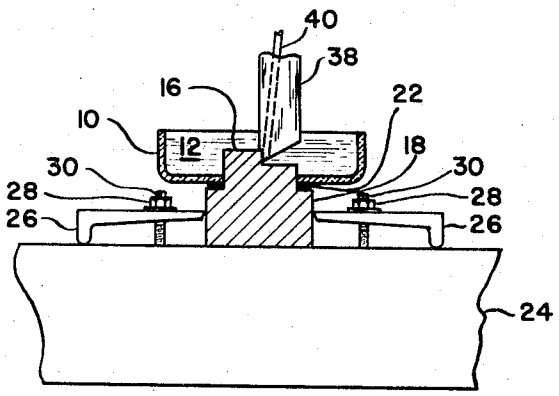


FIG. 2

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EMBRITTLEMENT MACHINING METHOD

This is a continuation of application Ser. No. 117,995, filed Feb. 23, 1971 and now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for machining metals which, heretofore, have been difficult or impossible to machine.

In a copending application Ser. No. 37,892, filed on May 15, 1970 and now U.S. Pat. No. 3,672,963 for "Process of Coating Metals With Mercury or Mercury Amalgams" and assigned to the assignee of the present invention, a process is disclosed for wetting metals with mercury or mercury amalgams whereby the surface layers of such metals are rendered brittle weak such that they can be machined more readily.

SUMMARY OF THE INVENTION

The present invention relates to the apparatus for machining metals which incorporates the embrittlement process of the aforementioned copending application.

Basically, the present invention provides; an electrolytic solution, a material to be machined immersed in said solution, cutting means adjacent said material to be machined and means for supplying an embrittling agent adjacent said material to be machined whereby upon the application of a voltage potential said material to be machined becomes the cathode and is wetted by said agent rendering the surface layers brittle and easy to machine.

According to the teachings of the aforementioned copending application, the embrittling agent may be mercury or mercury amalgam.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention reference should be had to the following detailed description of the same taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is a longitudinal schematic sectional view of the apparatus of the present invention; and

FIG. **2** is a sectional view taken along line **2—2** of FIG. **1.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIGS. **1** and **2,** a container **10** which may be glass, plastic or the like is adapted to hold on electrolytic solution **12** such as ethyl alcohol and perchloric acid. Suitable percentages would be 94 percent ethyl alcohol and 6 percent perchloric acid. The bottom of container **10** is slotted at **14** to receive therethrough the portion **16** of a workpiece **18** to be machined, which portion is immersed in the electrolyte **12.** Workpiece **18** may have an annular ledge **20** or other suitable structure extending beyond the slot **14** for the support of suitable sealing means **22** between the ledge and the bottom outer surface of container **10** to prevent leakage of electrolyte therefrom. Workpiece **18** is suitably clamped to a machine table **24** or the like by means of wedge shaped clamping blocks **26** and securing means in the form of nuts **28** and bolts **30,** which extend from the machine table through the blocks.

A positive electrode or anode **32** such as graphite is located in the electrolyte and is connected by lead **34** to the positive side of a suitable source of potential. A lead **36** from the negative side of the potential source is in contact with the immersed portion **16** of the workpiece, rendering the same a negative electrode or cathode. Cutting means in the form of a cutting tool **38** of any suitable machine tool, such as a shaper, planer or miller is located adjacent portion **16** of the workpiece and suitably adjusted with respect thereto for the proper depth of cut, during movement in the direction of arrow A. Behind the clearance face of tool **38** and adjacent portion **16** of the workpiece is provided means **40** for delivering an embrittlement agent to the workpiece. Means **40** may comprise a tapered small diameter tube with an opening at the surface of workpiece **18** being machined. In fact this tube may be structurally similar to conduits for supplying cutting fluids to workpieces, as is well known.

A suitable embrittlement agent **42** such as mercury or mercury amalgams is supplied via means **40** to the workpiece. The agent may be dispensed by means of fluid pressure, in which case means **40** would be suitably linked to a fluid pressure source.

The operation of the apparatus of the present invention will now be discussed. Assuming, for example and not limitation, that the workpiece is of a traditionally hard to machine material such as stainless steel, then with the portion thereof to be machined immersed in the electrolyte and a suitable voltage potential applied across leads **34** and **36,** the surface of the workpiece adjacent cutting head **38** and tube **40** becomes wetted with the agent **42** being supplied from tube **40.** The surface layers of the portion of the workpiece to be machined becomes uniformly coated with the agent as described in greater detail in the aforementioned copending Ser. No. 37,892. Once wetted with the agent, the material to be machined becomes relatively brittle and weak and the resistance offered to cutting tool **38** is, accordingly, greatly reduced. The cutting force and, consequently, the power requirements are significantly reduced. This results in a more efficient machining operation.

It has been found that a voltage potential across leads **34** of **36** of from 10 to 45 volts has functioned satisfactorily.

Additionally, although not essential, it has been found that placing the workpiece under a tensile stress facilitates the embrittlement process. Therefore, suitable means may be provided to place the workpiece under tensile stress during the machining operation. Such means would be additional to the tensile stresses normally generated by the cutting head.

Although a preferred embodiment of the invention has been disclosed and described, changes will obviously occur to those skilled in the art. It is therefore intended that the invention is to be limited only by the scope of the appended claims.

I claim:

1. Embrittlement machining method comprising the steps of:

1. placing in a container an electrolytic solution the main constituent of which is alcohol,
2. immersing a workpiece having a portion to be machined in said solution adjacent a cutting head,
3. supplying an embrittling agent of mercury or mercury amalgam to said portion of the workpiece,

4. placing a first electrode in said solution forming an anode, and
5. applying a voltage potential across said anode and said workpiece.

2. The method according to claim **1,** wherein:
6. said electrolytic solution comprises ethyl alcohol and perchloric acid.

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