United States Patent [19]

Sirantoine

[11] **3,777,528**

[45] **Dec. 11, 1973**

[54] **METHOD OF HOT PIERCING METAL BILLETS**

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[73] Assignee: **CEFILAC,** Paris, France

[22] Filed: **Nov. 19, 1970**

[21] Appl. No.: **91,120**

[30] **Foreign Application Priority Data**

Nov. 27, 1969 France 6940970

[52] **U.S. Cl.** **72/41,** 72/266, 72/256

[51] **Int. Cl.** **B21c 23/32**

[58] **Field of Search** ..... 10/86 F; 29/DIG. 18, 29/DIG. 47, 526.5, 526.6; 72/264, 265, 267, 343, 352, 370, 392, 413, 481, 41, 256; 30/358

[56] **References Cited**

UNITED STATES PATENTS

2,344,803	3/1944	Criley	72/254
2,956,337	10/1960	Buffet et al.	72/41
1,948,400	2/1934	Schlenstedt	72/263
2,183,182	12/1939	Bradley	72/263

FOREIGN PATENTS OR APPLICATIONS

193,142	1/1938	Switzerland	30/358
298,426	7/1919	Germany	72/343
729,317	5/1955	Great Britain	72/352

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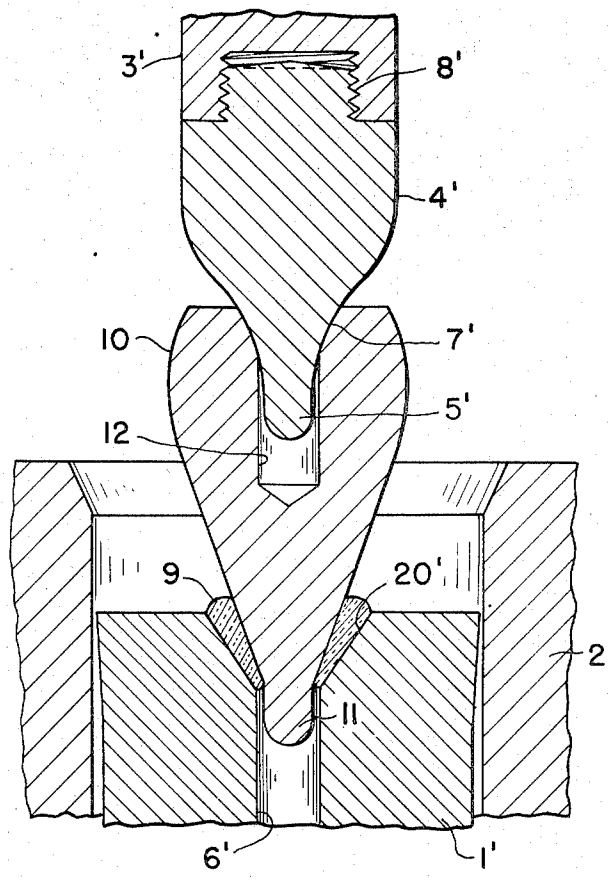
Assistant Examiner—E. M. Combs
Attorney—Webb, Burden, Robinson & Webb

[57] **ABSTRACT**

A billet containing an axially cold drilled cylindrical pilot hole and previously heated to deformation temperature is inserted into a hot piercing press. The pilot hole is flared at its forward end by a hot punching operation in the press itself prior to the application of the lubricant and the expansion operation. The hot punching can be done by a punching tool or by an expansion tool and the force of the press can be transmitted to the expansion tool in the expansion operation directly through a spindle or through the punching tool.

3 Claims, 2 Drawing Figures



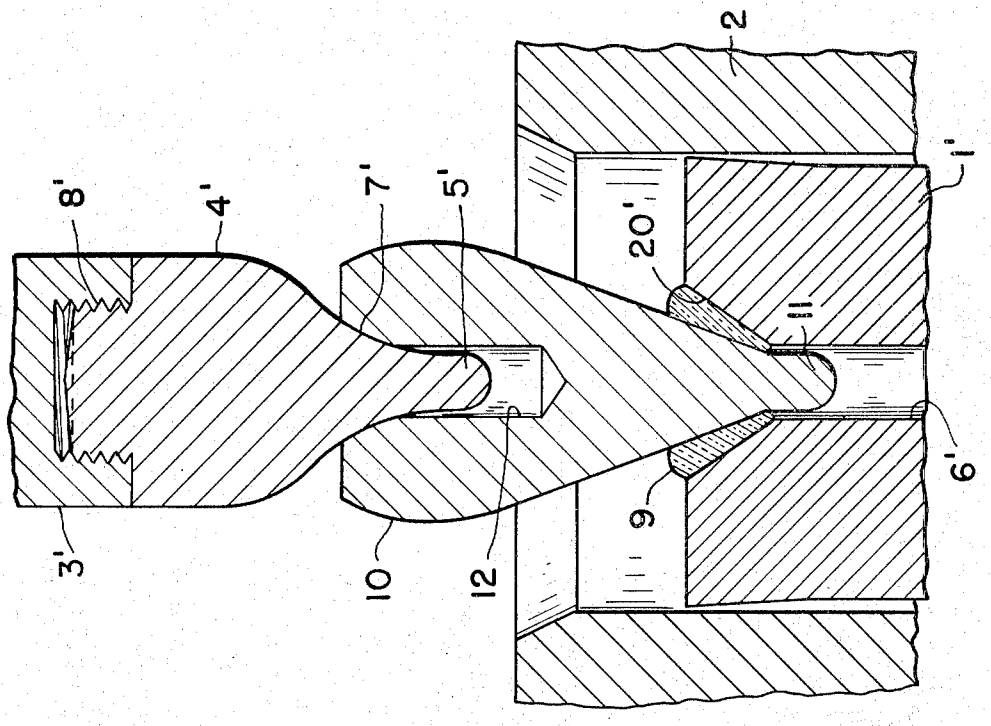


Fig. 2

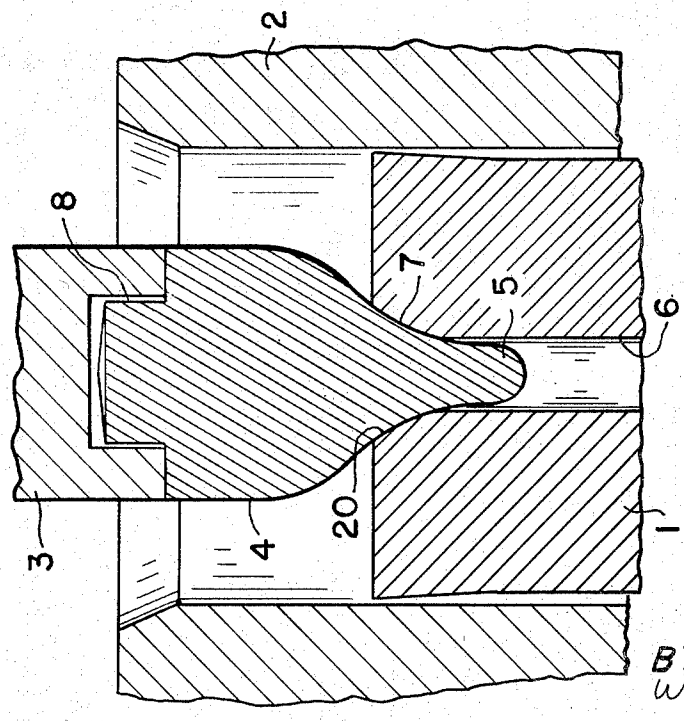


Fig. 1

INVENTOR.
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HIS ATTORNEYS

METHOD OF HOT PIERCING METAL BILLETS

My invention is directed to the hot piercing of metal billets, termed expansion. More particularly, it is directed to the expansion operation in which a pilot hole previously cold drilled into a billet is flared at its upper end in the piercing press prior to hot deformation by an expansion tool.

It is known in the art, see particular U.S. Pat. No. 2,956,337, to insert a billet having a cylindrical, axial pilot hole conically flared at one end into a piercing press container. The conically flared end permits proper penetration of the expanding tool and acts as a reservoir site for the lubricating powder. This method provides a satisfactory coaxiality of the pierced bore with the outside surface of the billet. However, not only does the billet have to be cold drilled, but the upper end of the cold drilled bore must be conically flared by machining, for example, on a lathe.

The present invention eliminates the machining operation while still forming the conical flare without any waste in time and material or investment in the necessary machining equipment employed heretofore.

In general, my invention consists of conically flaring the forward end of the cylindrical pilot hole by using a punching tool. This operation is carried out in the piercing press employing the same driving force, i.e., the press through a spindle, as is employed in the expansion operation.

In a first embodiment of my invention, the expansion tool itself is used for punching. After the conical flare has been punched the expansion tool is removed from the billet and a cohesive lubricant is positioned in the conical flare and then the expansion is carried out using the expansion tool.

In a second embodiment of my invention, the punching operation is done by a punching tool placed at the lower end of the spindle. After punching, the tool is removed and replaced by the expansion tool while a powdered lubricant is poured into the conical flare. The conical flare of the pilot hole is slightly greater than the conical surface of the expansion tool. The expansion is then carried out with the expansion tool.

In a third embodiment, the conical flare is impressed by a punching tool as in the second embodiment. However, after withdrawing the punching tool and inserting the lubricant, an expansion tool is positioned in the bore of the billet. The expansion tool has a rearward end adapted to matingly engage the forward end of the punching tool. The punching tool has a maximum diameter smaller than that of the expansion tool, it is not removed from the spindle, but is moved forward to matingly engage the expansion tool and then expansion is carried out.

In the accompanying drawings, I have shown my presently preferred embodiments of my invention in which:

FIG. 1 is a section through a piercing press container in which a punching tool is engaging the pilot hole of the billet; and

FIG. 2 is a section through a container of a piercing press in which an expansion tool and a punching tool are employed in mating engagement.

The punching of the conical flare can be done by the expansion tool itself when the lubricant is in the form of a cohesive mass. In this case the press is initially equipped with the expansion tool, according to known practice. While FIG. 1 is illustrative of the use of a punching tool 4 as described hereinafter, it is also illustrative of an expansion tool if one considers numeral 4 as being directed to an expansion tool. The force of the press is then applied until the expansion tool has punched a hole, e.g. 50 mm (2 inches) in diameter, on the upper face of the billet. The spindle and the expansion tool are withdrawn and the cohesive mass of lubricant is placed in the conical flare. The cohesive mass of lubricant can be, for example, a cohesive glass sheet such as a flexible sheet or a woven glass fiber or a cone of agglomerated glass powder such as that taught by U.S. Pat. application No. 11187 dated Feb. 13, 1970. The force of the press is once more applied and the expansion occurs in a known manner. Internal cohesion of the lubricating mass insures its continuous presence during the whole expansion operation.

The hot punching can also be done by a punching tool, as shown in FIG. 1. The container 2 of the piercing press holds the metal billet 1 which has been previously cold drilled to form pilot hole 6. Of course, the billet 1 is heated to its deformation temperature prior to being inserted into container 2. A punching tool 4 is attached to spindle 3 through an easily releasable connection 8. Connection 8 can be any of a number of different known connections and the particular type of connection does not form a part of this invention.

The punching tool 4 includes in turn, a nose section 5 capable of running into the pilot hole 6 of billet 1 without deforming it, a working surface 7 slightly more open that that of the expansion tool which will be used subsequently, and a cylindrical part having the same diameter as the spindle 3. In FIG. 1, the spindle 3 has transmitted the force of the press to the punching tool 4, forcing the punching tool 4 into the forward end of the billet to such an extent that the diameter of the resultant conical flare 20 at its upper end is about 50 mm (2 inches).

The sequence of operations of this embodiment includes punching a conical flare 20 in the forward end of the pilot hole 6, withdrawing the punching tool 4, placing a lubricating powder such as that taught by U.S. Pat. No. 2,956,337 into the conical flare created by the working surface 7 of punching tool 4, replacing the punching tool 4 with an expansion tool attached to the spindle 3 through the connecting device 8 and exerting the force of the press through the spindle 3 to force the expansion tool through the whole length of the billet in a known manner.

The method of forming the conical flare can be conducted with the punching tool of FIG. 1, which can then be used to transmit the force of the press to an expansion tool placed in the conically flared pilot hole. This is shown in FIG. 2 where punching tool 4' having nose portion 5' and working surface 7' is connected to spindle 3' through a standard connection such as a threaded shoulder 8'. Tool 4' is used to punch a conically flared surface 20' in the forward portion of pilot hole 6'. Tool 4' is withdrawn and a lubricating powder 9 is poured into the flare 20'. The forward section 11 of expansion tool 10 is then positioned in flare 20' and pilot hole 6', as shown in FIG. 2. Expansion tool 10 has a recessed rearward section 12 which is dimensioned to matingly engage with the nose section 5' of punching tool 4'. Expansion tool 10 has a maximum diameter which is equal to the desired expansion diameter and is larger than the diameters of both spindle 3' and the tool 4'.

The action of the press is continuous, initially moving the nose section 5' of punching tool 4' into mating engagement with rearward recessed section 12 of the expansion tool 10 and then forcing the expansion tool 10 through the whole length of billet 1'.

I claim:

1. A method of hot piercing metal billets having an axially cold drilled cylindrical pilot hole, and previously heated to deformation temperature comprising:

A. inserting a billet into a container of a piercing press;

B. punching a conical flare in a forward end of the pilot hole with an expansion tool through the force of the press so as to maintain a coaxiality of the pilot hole with an outside surface of the billet;

C. removing the expansion tool from the conical flare;

D. supplying a lubricant in a cohesive form to the conical flare; and

E. hot expanding the billet with the expansion tool.

2. A method of hot piercing metal billets having an axially cold drilled cylindrical pilot hole, and previously heated to deformation temperature comprising:

A. inserting a billet into a container of a piercing press;

B. punching a conical flare in a forward end of the pilot hole with a punching tool having a conical working surface of slightly greater angulation than that of an expansion tool used in the hot expansion, said punching performed through the force of the press so as to maintain a coaxiality of the pilot hole with an outside surface of the billet;

C. removing said punching tool from the conical flare and replacing it on the press with the expansion tool;

D. supplying a lubricant to the conical flare; and

E. hot expanding the billet with expansion tool.

3. A method of hot piercing metal billets having an axially cold drilled cylindrical pilot hole, and previously heated to deformation temperature comprising:

A. inserting a billet into a container of a piercing press;

B. punching a conical flare in a forward end of the pilot hole with a punching tool having a conical working surface of slightly greater angulation that that of an expansion tool used in a hot expansion, said punching performed through the force of the press so as to maintain a coaxiality of the pilot hole with an outside surface of the billet;

C. removing the punching tool from the conical flare;

D. supplying a lubricant to the conical flare;

E. inserting a forward end of the expansion tool into the conical flare, said expansion tool having a recessed rearward end and a maximum diameter greater than that of the punching tool;

F. matingly inserting the punching tool into the recessed rearward end of the expansion tool; and

G. hot expanding the billet with the expansion tool, the force of the press being transmitted to the expansion tool through the punching tool.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,777,528 Dated December 11, 1973

Inventor(s) Albert Sirantoine

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1 Line 8 --particular-- should read --in particular--. Column 2 Line 30 --that that-- should read --than that--. Claim 3, Column 4 Line 15 --that that-- should read --than that--.

Signed and sealed this 16th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.