United States Patent

[11] 3,599,281

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[54] **HEAT INSULATING CASING**
10 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **18/5 H,** 18/16 R, 18/17 A, 29/420, 29/421, 75/214, 75/226, 264/111, 264/125
[51] **Int. Cl.** **B22f 3/12**
[50] **Field of Search** ..... 18/5 H, 16 R, 16.5, 16.7, 17 A; 75/214, 226; 264/111, 125; 29/420, 421

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ABSTRACT: This invention relates to the compacting of powdered-metal charges by fluid-pressure application in an autoclave, while said charge is at elevated temperature to eliminate the need for heating in the autoclave. In accordance with the invention, heat dissipation from the charge is minimized by the use of a removable heat-insulating casing that covers the charge after it has been heated externally of the autoclave and until compacting has been completed in the autoclave.

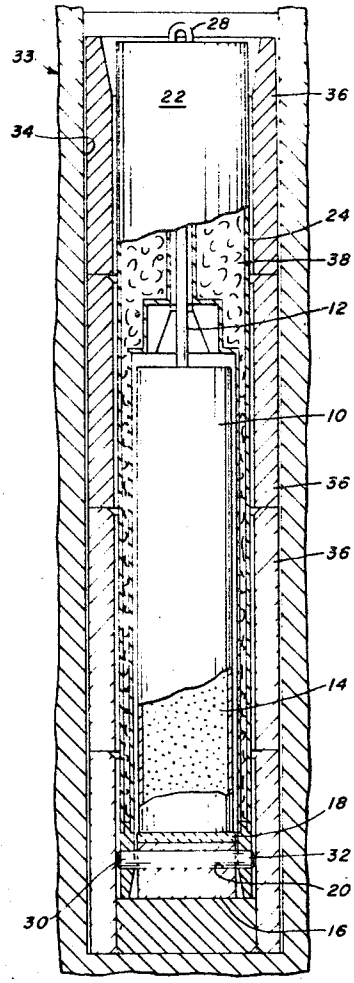


FIG. 1.

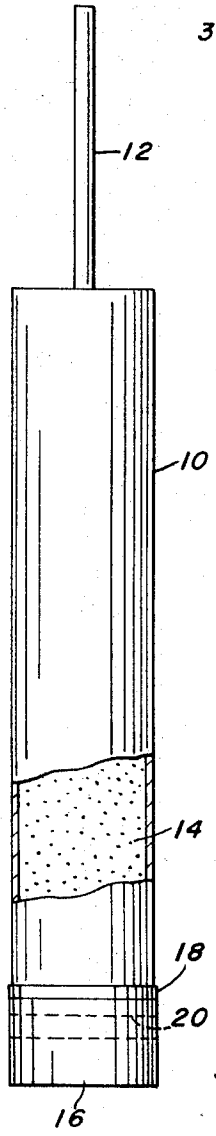


FIG. 2.

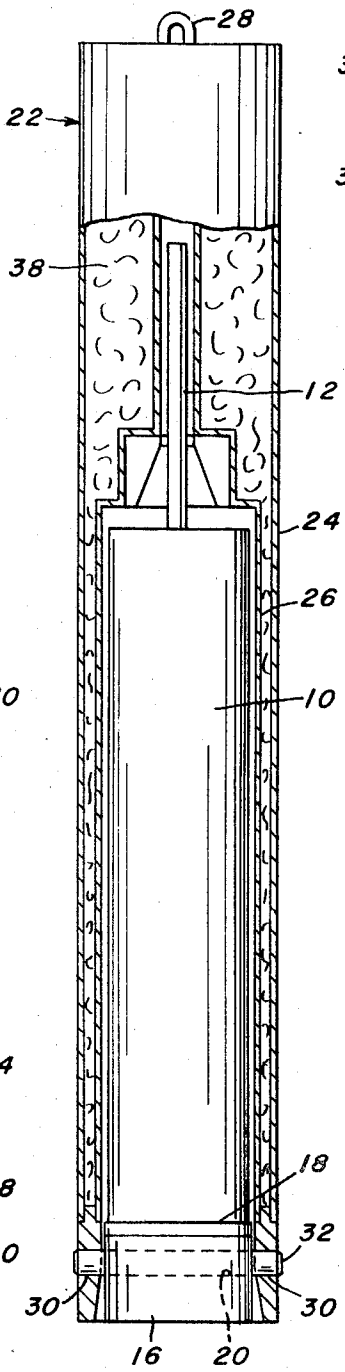
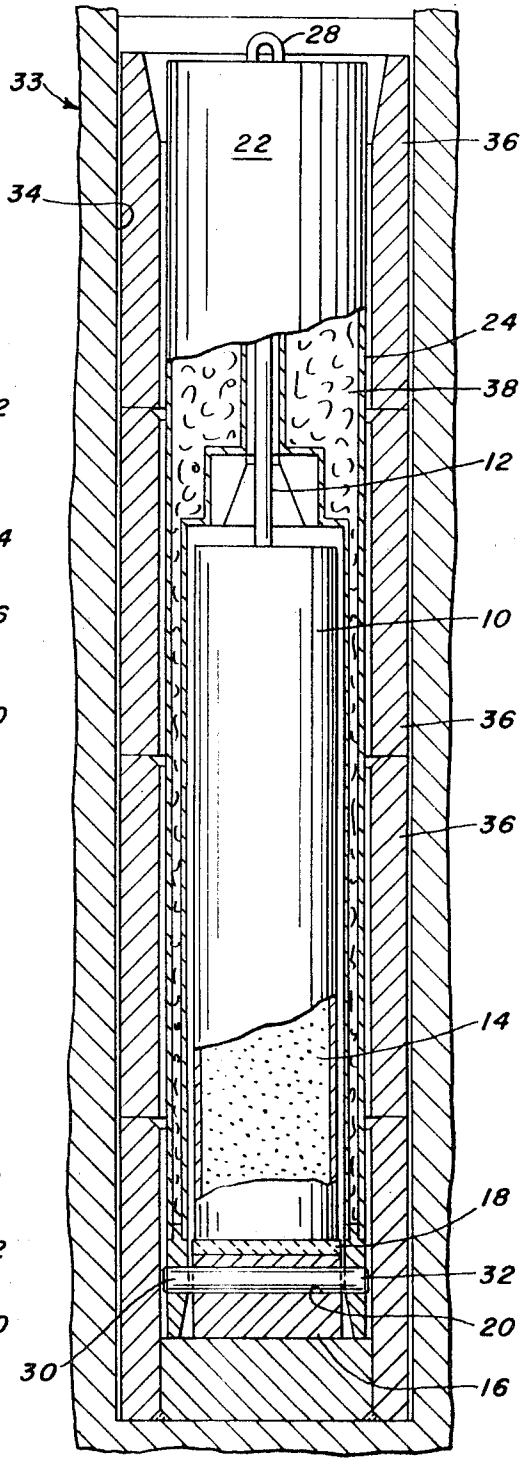


FIG. 3.



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HEAT INSULATING CASING

It is well known that by the use of powdered metallurgy techniques, it is possible to produce metal articles, such as high alloy tool steel articles, of fine grain size and homogeneous microstructure. The conventional practice for producing articles of this type is to place a charge of powdered metal of, for example, −100 mesh within a closed container that has been evacuated to a relatively low pressure. The container with the powdered-metal charge therein is next heated to an elevated temperature of, for example, at least about 2,000° F. While at this high temperature, the charge is placed in a fluid-pressure vessel, which is commonly termed an autoclave, for compacting by the application of fluid pressure. Although many types of fluid-pressure media may be employed, it is typical to use a gas, such as helium. In compacting operations of this type, to achieve adequate density during compacting, which typically must be about 95 percent or greater, it is critical that the powdered-metal charge not be permitted to cool below the temperature at which upon pressure application the required compact density will be achieved. Since the charge-filled container must be heated to compacting temperature in a furnace, removed from the furnace when the required temperature has been achieved, and transported to an autoclave for compacting, substantial heat loss can result during this sequence. If, to counteract the heat loss, the charge is heated to temperatures far in excess of that required for compacting, such high temperatures will cause undesirable metallurgical changes, such as carbide and sulfide growth and agglomeration. Particularly in the case of tool steel articles, agglomeration of carbides and sulfides results in a lessening of the cutting life of any tools made from such material. Alternately, if the charge is supplied with supplemental heat while in the autoclave, this adds substantially to the size, cost and complexity of the autoclave apparatus, as well as to the time that the charge remains in the autoclave.

It is accordingly the primary object of the present invention to provide for the high-temperature compacting of powdered metal charges in an autoclave wherein heat loss is minimized during transport of the charge from the heating furnace to the autoclave, and during the time in the autoclave prior to compacting.

A more particular object of the invention is to provide a heat-insulating casing covering the powdered-metal filled container during transport thereof from the heating furnace to the autoclave, whereby supplemental heating of the charge within the autoclave may be eliminated.

Yet another object of the invention is to provide a heat-insulating casing for use in preventing heat loss from a powdered-metal filled container, said heat-insulating casing being adapted to permit unitary removal of the container and casing from the furnace and transport to the autoclave.

Another related object of the invention is to provide a casing that will insulate the powder-filled container against heat loss and will also protect the interior of the autoclave from damage by the high temperatures and scale of the container.

These and other objects of the invention, as well as a complete understanding thereof, will be obtained from the following description and drawings, in which:

FIG. 1 is an elevational view of a typical cylindrical container for a powdered-metal charge, with parts broken away to show the powdered metal therein;

FIG. 2 is an elevational view of the container of FIG. 1 with the heat-insulating casing, with portions of the casing broken away to show the heat-insulating material therein, in accordance with the present invention positioned thereover; and

FIG. 3 is an elevational view in partial, vertical section of the container and casing of FIG. 2 positioned in an autoclave for compacting, with portions of the container and casing broken away to show the heat-insulating material therein.

Broadly, the present invention comprises a heat-insulating casing having an interior conforming substantially to the configuration of the container of powdered metal to be compacted. When the charge has reached the required compacting temperature within a furnace-located exterior of the autoclave, it is separated from the furnace and the heat-insulating casing of the invention is lowered, as by the use of an overhead crane, to cover the container. Means are provided near the bottom of the casing for connecting the same to a base or pedestal upon which the container rests during heating in the furnace. The connection, is such as to permit the container, base and heat-insulating casing to be removed from the furnace as a unit by the use of an overhead crane and transported thereby to an autoclave. For this purpose the connection may comprise a pin that is passed through the casing and into the base or alternately a pin that is fixed in the base and locks into a slot in the casing. The unit is then positioned in the autoclave for compacting. By this arrangement, the time between the completion of heating and the beginning of compacting is greatly minimized and, in addition, the heat-insulating casing minimizes heat loss from the charge during transport and prior to compacting in the autoclave. Preferably, the heat-insulating casing comprises an inner shell that conforms substantially to the configuration of the powder-filled container and an outer shell that is generally cylindrical to conform to the generally cylindrical autoclave. The outside diameter of the casing should be only slightly less than the inside diameter of the autoclave to further minimize heat loss while the unit is within the autoclave awaiting the application of fluid pressure for compacting. The inner and outer shells are in spaced-apart relation to create a space therebetween that is filled with a heat-insulating material, such as zirconia.

With reference to FIGS. 1 through 3 of the drawings, there is shown a cylindrical container **10**, which may be constructed from a mild steel, having an upwardly extending stem **12**. As best shown in FIG. 1, the container interior is filled with a charge of powdered metal **14** to be compacted. Stem **12** of the container permits connection to a means, such as a pump, for evacuating the container interior after it has been filled with the powdered-metal charge. The container may typically have a 10-inch diameter with a length of 47 inch.

During heating, the container is supported in an upright position, as shown in the figures, on a base or pedestal **16**. The top or supporting surface of the pedestal is provided with a refractory pad **18**. A drilling **20**, which is normal to the axis of the base **16**, is provided to accommodate a pin connection used for connecting the heat-insulating casing to the container **10** and base. This casing, which is indicated generally as **22**, is best shown in FIG. 2. The casing **22** comprises an outer shell **24** of generally cylindrical configuration and an inner shell **26** having dimensions slightly greater than but conforming with those of the container **10**. In this manner, the casing **22** may be placed over the container, as by the use of an overhead crane (not shown), to cover said container as shown in FIG. 2 of the drawings. To permit lifting and transport of the casing **22**, a crane hook **28** is provided on the top thereof. Near the bottom of the casing, there are provided axially aligned openings in the shells **24** and **26** that are aligned with drilling **20** in the base **16** upon positioning of the casing over the container and base. With the casing in this position, as shown in FIG. 2, a pin **32** is inserted through the openings **30** and drilling **20**. This serves to connect the casing with the base **16**, and upon lifting of the casing, as by connection of a crane hook at **28**, the container **10**, base **16** and heat-insulating casing **22** may be lifted as a unit from the furnace and repositioned as a unit in an autoclave. As an alternate arrangement, the pin may be fixed within the base and thus extend therefrom in opposite directions as stationary lugs. Slots are provided in the bottom of the casing into which the pin ends or lugs may be locked as by turning the casing about its vertical axis upon positioning of the lugs within the slots. The unitary positioning of the container, base and heat-insulating casing within an autoclave is shown in FIG. 3 of the drawings. The autoclave, a portion of which is shown in FIG. 3 and designated generally as **33**, has a cylindrical interior **34** that is lined with removable stacked cylindrical inserts **36**. The inserts **36** act as an armor to protect

the autoclave interior. These inserts may be of various diameters depending upon the diameter of the heat-insulating casing to be positioned in the autoclave. As pointed out hereinabove, the space between the inserts and the outside shell of the heat-insulating casing should be minimized as an aid in reducing heat loss while the unit is in the autoclave awaiting the application of fluid pressure for compacting. Heat loss is further minimized by the space between the shells **24** and **26** of the casing being filled with a heat-insulating material **38**, which may be a refractory or insulating oxide material, such as zirconia, magnesia or silica. Because of the high temperatures involved, the shells **24** and **26** of the casing are preferably constructed from a heat-resistant material, such as stainless steel.

Although various embodiments of the invention have been shown and described herein, it is obvious that other adaptations and modifications may be made by those skilled in the art without departing from the scope and spirit of the appended claims.

I claim:

1. In combination with a container having therein a powdered-metal charge to be compacted by fluid-pressure application while at elevated temperature, a removable heat-insulating casing for minimizing cooling of said powdered-metal charge after said charge has been heated in a furnace to compacting temperature and prior to compacting.

2. A heat-insulating casing as recited in claim **1** having an interior conforming substantially to the configuration of said container and covering a major portion thereof.

3. A heat-insulating casing as recited in claim **1** having means for removably connecting said casing to a portable base upon which said container is supported.

4. The apparatus of claim **3** wherein said means for removably connecting said casing to said base includes a pin that extends through said casing and into said base.

5. A heat-insulating casing as recited in claim **1** having an inner shell and an outer shell in spaced-apart relation.

6. A heat-insulating casing as recited in claim **5** having a heat-insulating material between said inner and outer shells.

7. A heat-insulating casing as recited in claim **6** wherein said heat-insulating material is selected from the group consisting of zirconia, magnesia and silica.

8. In combination with a container having therein a powdered-metal charge to be compacted by fluid-pressure application while at elevated temperature, a removable heat-insulating casing for minimizing cooling of said powdered-metal charge after heating to compacting temperature and prior to compacting, said casing comprising an inner shell and an outer shell in spaced-apart relation, said inner shell conforming substantially to the configuration of said container and covering a major portion thereof, a heat-insulating material between said inner and outer shells, and means for removably connecting said casing to a portable base upon which said container is supported.

9. The casing of claim **8** wherein said means for removably connecting said casing to said base includes a pin that extends through said inner and outer shells and into said base.

10. A method for producing a compact by fluid-pressure compacting a powdered-metal charge at elevated temperature within a container, comprising providing a container having therein a charge of powdered metal to be compacted, heating said container and charge in a furnace to an elevated temperature not less than a selected compacting temperature at which said charge is to be compacted, covering said container with a removable, heat-insulating casing, removing said casing and container from said furnace as a unit and placing said unit within a fluid-pressure vessel, and compacting said powdered-metal charge by the application of fluid pressure before said charge cools to a temperature below said selected compacting temperature.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,599,281 Dated August 17, 1971

Inventor(s) Charles Benjamin Boyer

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

Column 2, line 23, after "autoclave", insert --interior, which reduces the void volume within the autoclave--.

Column 2, line 38, change "inch" (second occurrence) to --inches--.

Signed and sealed this 4th day of January 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents

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