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Onder

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[54] **DEVICE FOR HOT PRESSING OF CERAMIC MATERIALS**

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[52] **U.S. Cl.** **425/352**, 425/330, 425/407, 249/78, 249/82, 249/134, 249/163

[51] **Int. Cl.** **B28b 3/08**

[58] **Field of Search** .... 425/405 H, 330, 344–345, 425/352–353, 78, 407, 411; 249/82, 134, 160, 162–163, 167

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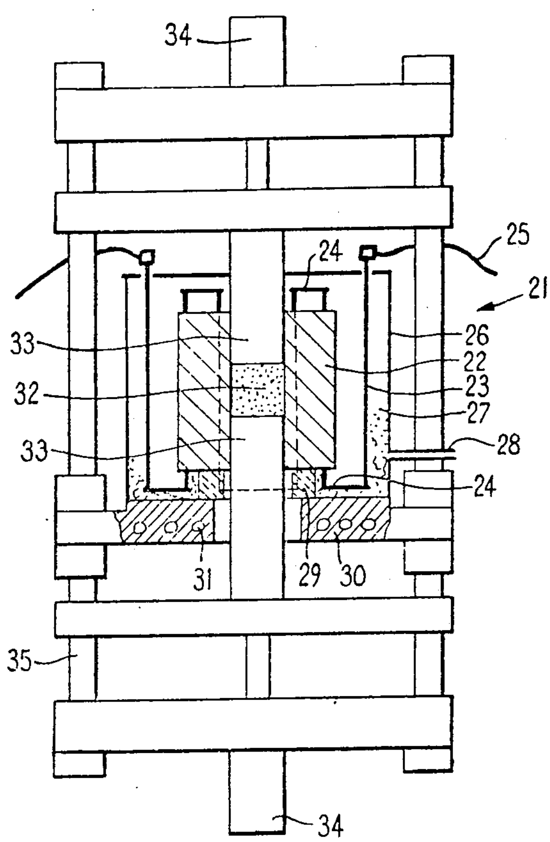
Assistant Examiner—John McQuade
Attorney, Agent, or Firm—Ernest F. Marmorek

[57] **ABSTRACT**

A device for hot pressing of ceramic materials in powder form or fine granular form, comprising a mold defining a longitudinal cavity and built up of graphite plates arranged in succession along its length each plate lying perpendicular to the wall of the mold cavity, at least one layer between each plate and the next, these layers being resistant to high temperature, electrically ensulating, and ceasing at some distance from the wall of the mold cavity, and electrically conducting carbon material filling the slots thus resulting in the wall of the mold cavity.

4 Claims, 16 Drawing Figures



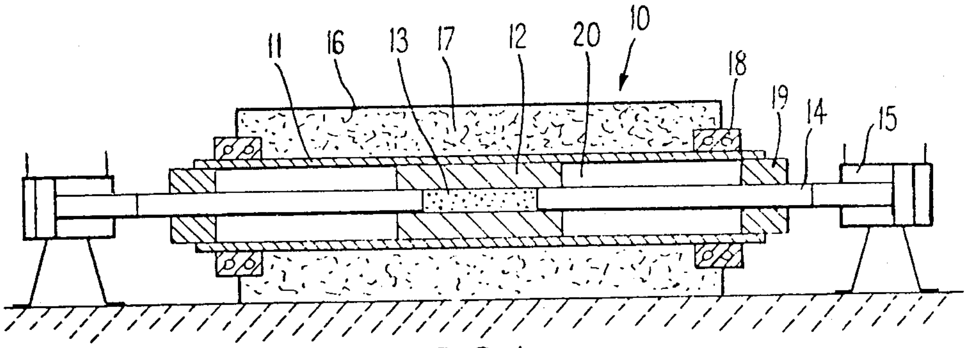

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FIG. 1

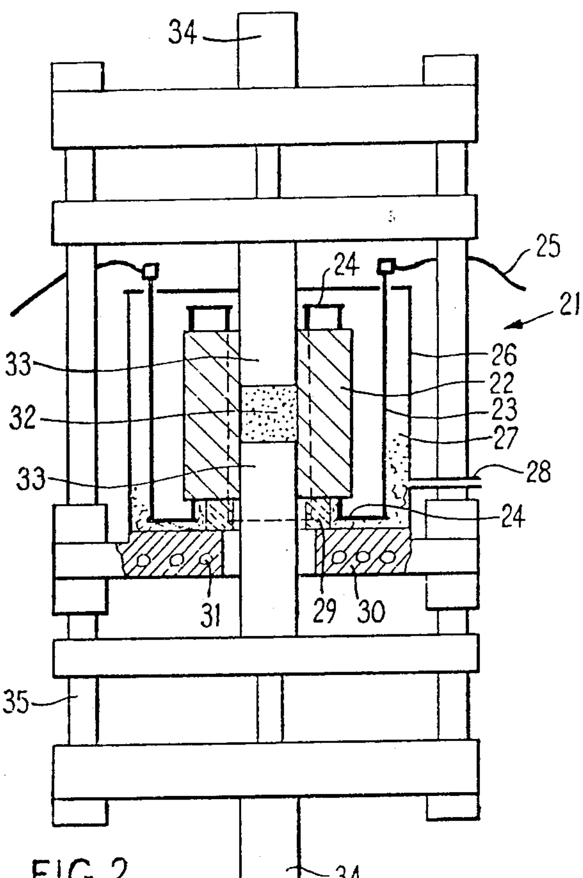
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FIG. 2

FIG. 3

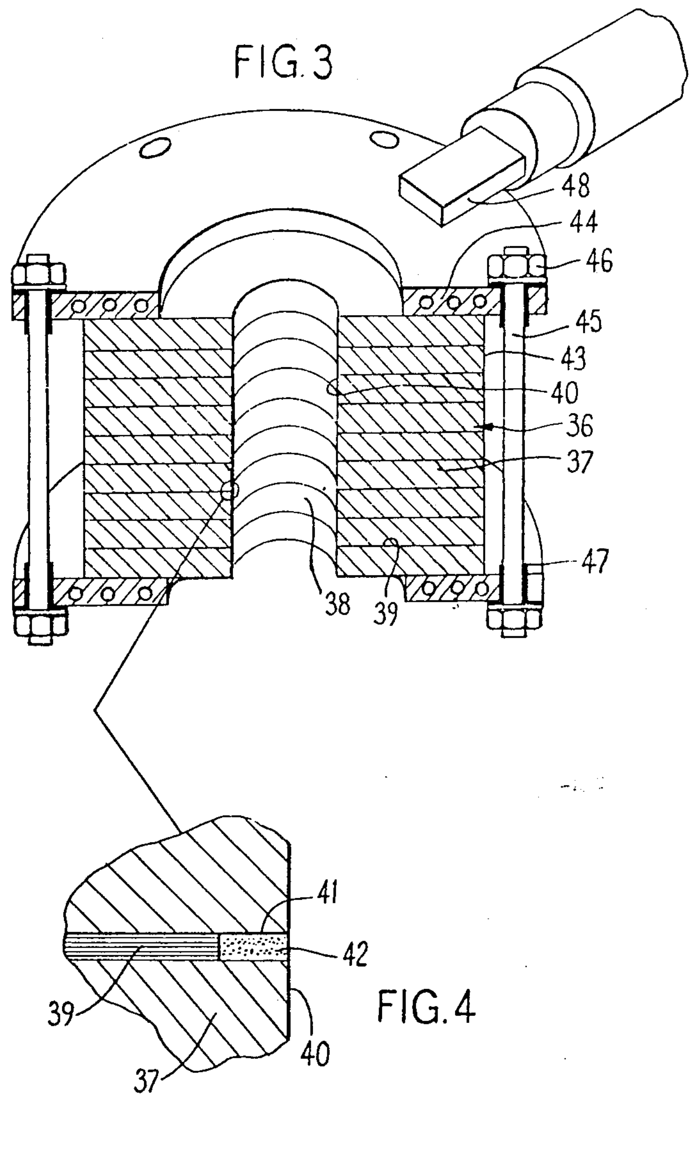


FIG. 4

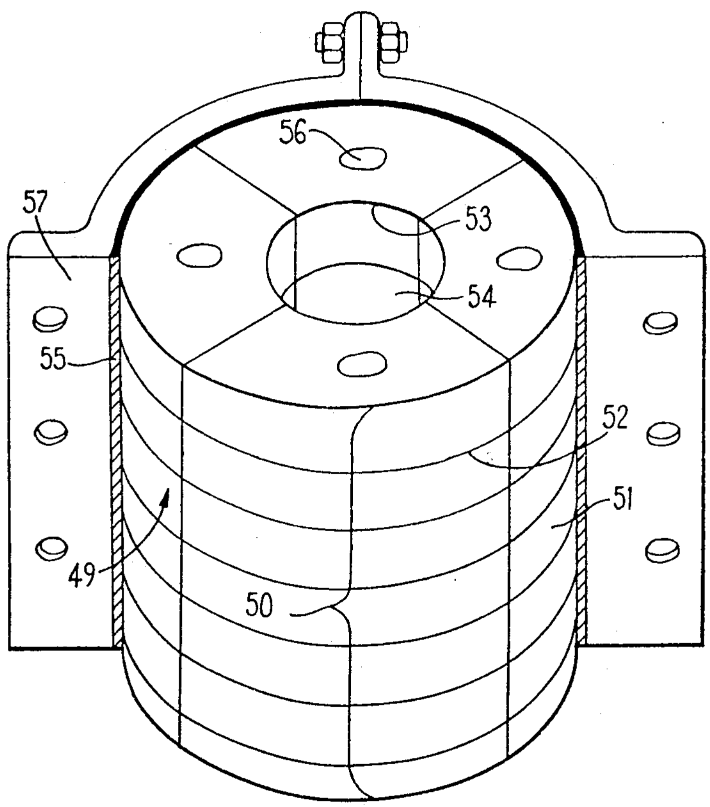


FIG.5

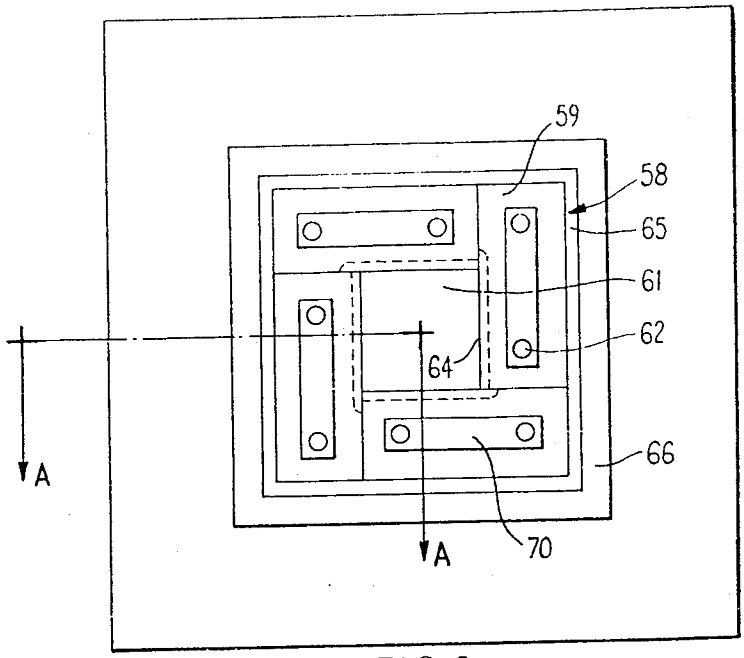


FIG. 6

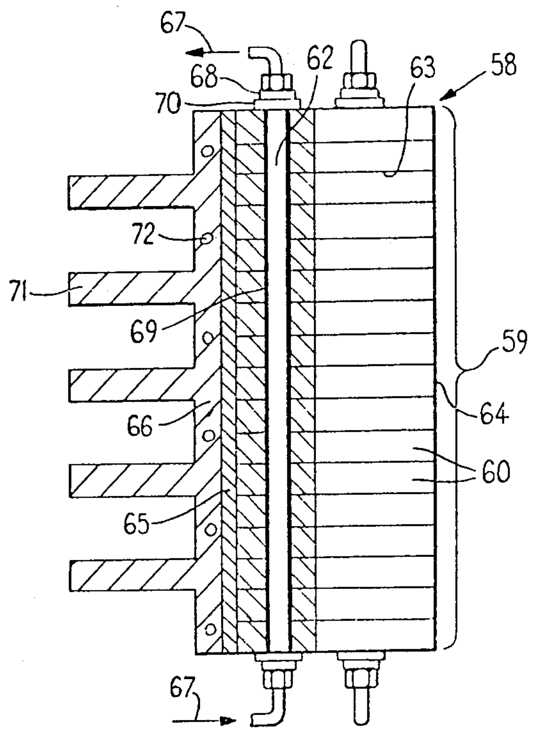
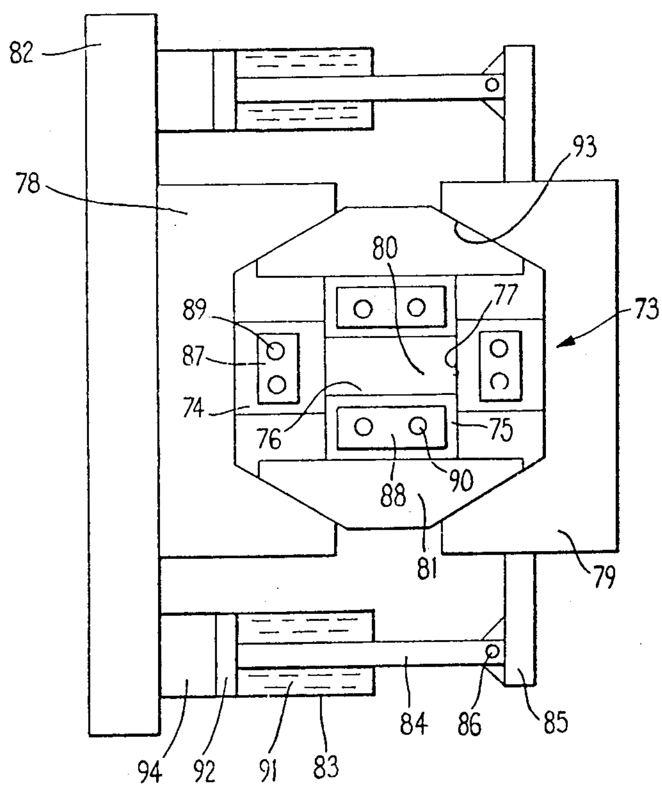


FIG. 7

FIG.8



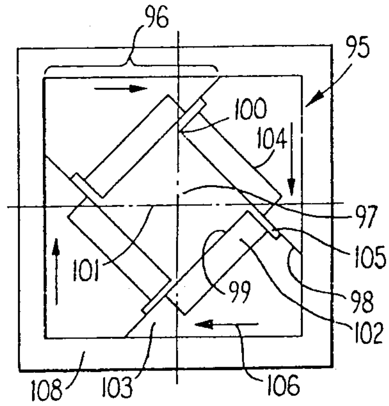


FIG. 9

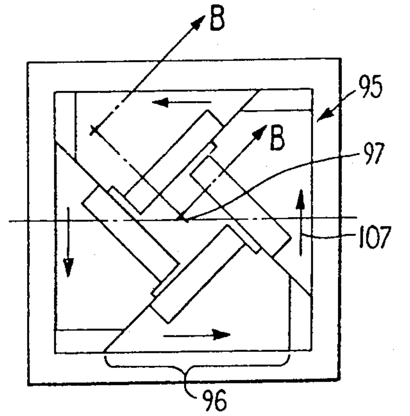


FIG. 10

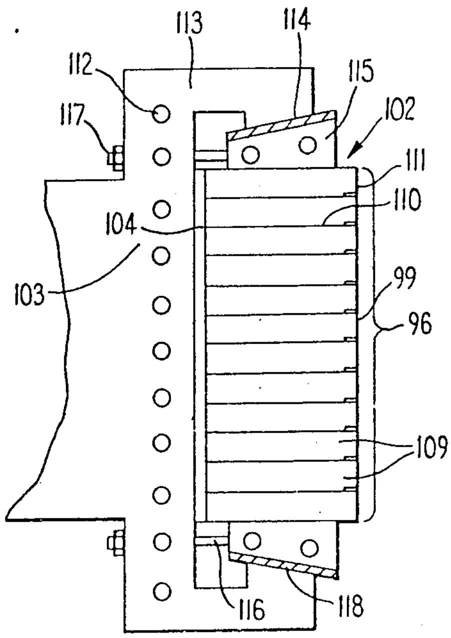


FIG. 11

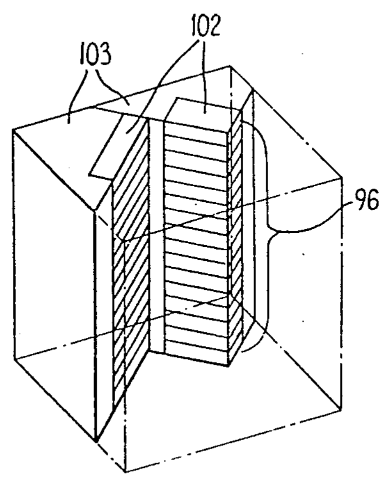


FIG. 12

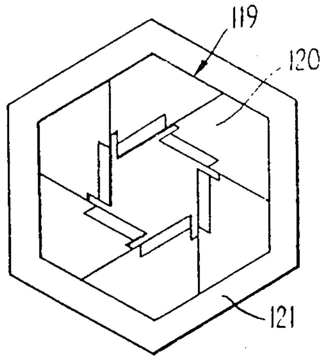


FIG.13

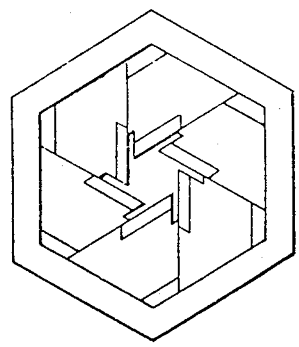


FIG.14

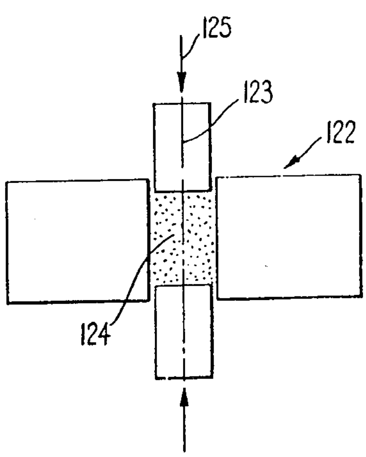


FIG.15

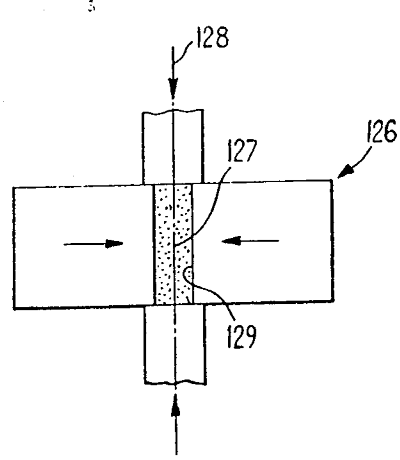


FIG.16

DEVICE FOR HOT PRESSING OF CERAMIC MATERIALS

BACKGROUND OF THE INVENTION

The invention relates to devices for hot pressing of ceramic materials in powder or fine granular form.

The hot pressing of ceramic materials in powder or fine granular form such as boron nitride, titanium diboride, titanium nitride, zirconium diboride, and titanium carbide usually takes place in graphite molds which are open at both ends, and which are mounted in a furnace. Press plungers, which likewise consist of graphite, move axially in the mold and are operated by hydraulic cylinders arranged outside the furnace.

FIGS. **1** and **2** show schematically two known hot pressing devices in vertical section.

The conventional hot device shown schematically in FIG. **1** has an electrical furnace **10** with tubular graphite resistance **11.** A graphite tube **12** serves as mold, in which lies the mass **13** of ceramic material in powder form which is to be hot pressed. From both ends of the furnace press plungers **14** of graphite are inserted into the graphite tube **12.** With their help the mass **13** is pressed together under high pressure (e.g. to 200 atmospheres) and at high temperature (e.g. to 2,500° C). Two hydraulic press cylinders **15** serve for moving the press plungers **14.** At **16** is indicated a jacket of asbestos plates and at **17** a heat-insulating filling (e.g. of soot). At **18** are water-cooled connections of copper for the heating current and at **19** guide bushes of graphite. A cavity **20** is filled with protective gas. This device permits the manufacture of pressings up to about 150 mm diameter.

FIG. **2** shows schematically a known device which is employable for the production of significantly larger pressings, e.g. of 500 mm diameter and 500 mm length. The furnace is arranged vertically. A mold **22** of graphite is heated by means of convection and radiation by graphite heating bars **23,** which are arranged concentrically around the mold **22.** The heating bars **23** are connected together alternately above and below by connecting pieces **24** of graphite, so that all the heating bars are connected in series. At **25** current connections are indicated. At **26** is indicated an asbestos housing and at **27** a heat-insulating filling, e.g. of soot. Protective gas, e.g. argon, is introduced through a tube **28.** At **29** are indicated fireproof blocks which provide a support for the mold **22** and which rest on the floor **30.** The floor **30** consists of cast steel and is cooled by cast-in water passages **31.** As in the device shown in FIG. **1,** the ceramic mass **32** in powder form is pressed together by means of two plungers **33** of graphite, actuated by hydraulic press cylinders **34.** At **35** is indicated the machine frame.

The maximum size of ceramic body to be produced is determined by the dimensions of the graphite mold **22.** For manufacturing reasons these dimensions cannot be chosen as large as one may wish. For example, a cylindrical mold with an internal diameter of 450 mm requires an external diameter of about 1,000 mm (wall thickness 275 mm) in order to be able to withstand the circumferential tension loads which arise during pressing. The wall thickness of the mold **22** is primarily determined by the tension loads to which it is subjected, so that it must be extraordinarily large because of the very low breaking limit of the graphite.

SUMMARY OF THE INVENTION

According to this invention, a device for hot pressing of ceramic materials in powder form or fine granular form comprises a mold defining a longitudinal cavity and built up of graphite plates arranged in succession along its length, each plate lying perpendicular to the wall of the mold cavity, at least one layer between each plate and the next, these layers being resistant to high temperature, electrically insulating, and ceasing at a distance preferably not less than 1 mm and not more than about 5 mm from the wall of the mold cavity, and electrically conducting carbon material filling the slots thus resulting in the wall of the mold cavity.

Therefore the devices according to the invention have a mold which simultaneously serves as the tool determining the shape and as the electrical resistance element. The said mold is able to be employed for carrying out the pressing operations described initially (FIGS. **1** and **2**).

The electrically insulating layer between the graphite plates should be at least so thick that it prevents a break through of the heating current, but not so thick that the conduction of current through the carbon material in the slots is impaired. The least thickness lies around 0.1 mm. The greatest thickness will suitably not exceed 1 mm. A thin insulating layer can advantageously be applied by flame spraying, for example of aluminium oxide or boron nitride. It is sufficient if only one of the graphite layers which are to come into mutual contact is provided with the flame-sprayed insulating layer, but of course both the graphite surfaces coming into contact with one another can have this insulating layer. A thicker insulating layer can be achieved by application of elastic material, for example of ceramic fibres such as "Fiberfrax" (Registered Trade Mark), which, in the manufacture of the mold, can be compressed to a thickness of for example 0.7 to 0.4 mm under the clamping force exerted on the graphite plates.

The thickness of the graphite plates should conform with the size of the molds and the electrical data. For example, with a mold of 80 mm internal diameter and 250 mm external diameter, with 1 mm deep slots in the inner wall and 0.4 mm thick insulating layers, one can choose graphite plates 5 to 10 mm thick. In contrast, with a mold of 500 mm internal diameter and 1,000 mm external diameter, with 3 to 5 mm deep slots in the inner wall and 0.4 mm thick insulating layers, significantly thicker graphite plates are more suitable, already for manufacturing reasons, for example from 50 to 80 mm.

The graphite plates should be made parallel-sided and have surfaces as smooth as possible.

By the presence of the electrically insulating layers, which cease at a distance not less than **1** mm from the wall of the mold cavity, the electrical heating current is compelled to flow along the inner wall of the mold. This constriction of the conducting cross sections of the mold makes possible the employment of a thick-walled mold as an electrical resistance element for attainment of very high temperatures in the mold cavity in a usable time limit and with satisfactory thermal efficiency. With the employment of a thick-walled mold without restricted conducting cross section as the electrical resistance element, due to the very low electrical resistance of the graphite body, extremely high and constructively difficultly controllable current loads would arise when working with voltages which are favourable to handle; furthermore the entire graphite body of the mold would unnecessarily have to be brought to the same temperature, which would be extremely inefficient. With a graphite mold with restricted conductive cross section and a mold cavity diameter of 450 mm it is possible to apply voltages of, for example, 20 to 40 volts, without current strengths being achieved which are difficult to control. Current strengths easily controllable lies for example at 20,000 to 30,000 amps, while current strengths of about 80,000 amps and more in such an apparatus would be difficult to control.

The form of construction of mold described above also yields the following important advantages:

a) By the use of several plates, the employment is possible of graphite of greater mechanical strength than in continuous-walled graphite molds.

b) The temperature gradient in the mold wall falls steeply from inside to outside. Because of the significant temperature gradient from inside to outside there is established, in consequence of the thermal expansion in the graphite body, a state of stress, which is superimposed on the state of stress created by the radial press pressure, so that one can speak of a pre-stressing of the mold in the direction towards the mold cavity.

c) The combination of the small conducting cross section for the electrical heating current with the thick mold wall produces a robust construction.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the invention. In these drawings:-

FIGS. **3** to **14** illustrate schematically various devices embodying the invention.

FIG. **3** shows in perspective in vertical longitudinal section a first device with a circular mold and

FIG. **4** is a detail of FIG. **3**.

FIG. **5** shows in perspective a second device with a circular mold, with omission of the front clamping elements.

FIG. **6** shows a third device entirely schematically and FIG. **7** is a section along the line A—A in FIG. **6**.

FIG. **8** shows entirely schematically a fourth device with a mold which can be unloaded, in the pressing position (closed position).

FIG. **9** is a purely schematic showing of a fifth device, with longitudinal mold segments, in pulled apart position.

FIG. **10** shows the same device with the longitudinal mold segments, in pushed together position.

FIG. **11** shows in a section along the line B—B of FIG. **10** and in more detailed illustration, but still only schematically, the device according to FIGS. **9** and **10**.

FIG. **12** is a diagrammatic illustration of the mold according to FIG. **10**, partly in broken lines.

FIG. **13** shows schematically in plan a sixth device, with a mold divided into six longitudinal segments, in pulled apart position, and

FIG. **14** shows the same device in pushed together position (in pressing position).

FIG. **15** shows the employment of a device as stationary pressing mold and

FIG. **16** shows the employment of a device as a quasi-isostatic press.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The example shown in FIGS. **3** and **4** has a round mold **36** about 680 mm long, which is assembled out of nine superimposed annular graphite plates **37**. The graphite plates **37** have each a thickness of **75** mm and an external diameter of 600 mm and form a mold cavity **38** of 300 mm diameter, in which the fine granular ceramic material is pressed together with the help of graphite plungers not shown. Between each graphite plate **37** and the next there is a layer **39** 0.5 mm thick, of "Fiber- frax" (Registered Trande Mark), which ceases at 4 mm from the wall **40** of the mold cavity **38**. This layer is resistant to high temperature, and is electrically insulating. The slots **41** (FIG. **4**) remaining in the wall **40** are filled with an electrically conducting carbon material **42**, for example with finely ground natural graphite. This can, during manufacture of the mold, be applied as a suspension in mineral oil. The outer wall of the mold **36** is provided with a jacket **43** several mm thick of several layers of asbestos paper. The graphite plates **37** are clamped together between water-cooled clamping and contact plates **44** of copper with the help of water-cooled clamping bolts **45** formed as weldless steel tubes, with nuts **46**. For the sake of simplicity the supply of water to, in, and from the clamping and contact plates **44** is not shown; the same is true of the water supply to and from the clamping bolts **45**. The clamping bolts **45** are electrically insulated from the clamping plates **44**, e.g. by procelain or asbestos inserts **47**. At **48** are shown the heating current connections to the clamping and contact plates **44**.

In the example shown in FIG. **5** the circular mold **49**, which has the same dimensions as the mold **36** in FIG. **3**, is divided into four equal longitudinal segments **50**. As in the construction according to FIG. **3**, there is arranged between each graphite plate **51** and the next a layer **52** 0.5 mm thick of "Fiberfrax," which ceases at 4 mm from the wall **53** of the mold cavity **54**. The slots remaining in the wall **53** are filled with electrically conducting carbon material, as in FIG. **4**. There is a thermally and electrically insulated jacket **55** of asbestos on the outer wall of the mold **49**. This is shown in section. For the sake of clarity the watercooled clamping and contact plates are not shown, nor are the current connections and the hollow clamping bolts, which are introduced through openings **56** in the graphite plates **51** and which hold together the graphite plates **51** with the help of nuts. The hollow clamping bolts, not shown, are electrically insulated from the clamping and contact plates as well as from the graphite plates **51**. They are passed through by cooling water during use of the mold. They consist of weldless steel tube and have an external diameter of about 40 mm and an inner diameter of about 15 mm. There is a casing **57**, only the rear half of which is shown. This casing **57** is preferably water-cooled. It accepts during the pressing operation alle the external forces, so that the graphite is only subjected to pressure.

FIGS. **6** and **7** show a device in which the mold **58** consists of four longitudinal segments **59**, each of which is built up of seventeen rectangular graphite plates **60**. The mold cavity **61** is square in cross section.

The plungers for pressing the ceramic material are, for the sake of clarity, not shown. The graphite plates **60** of each segment are held together by two hollow water-cooled clamping bolts **62** of steel, as is apparent from FIG. **7**. Between the individual graphite plates **60** are arranged insulating layers **63** which can withstand high temperature, which cease at a distance not less than 1 mm from the wall **64** of the mold cavity, while the slots remaining in the wall **64** are filled with electrically conducting carbon material, as in FIG. **4**. Everywhere where the graphite plates **60** do not form a part of the wall **64** of the mold cavity **61**, the insulating layer **63** extends up to the edge of the graphite plates **60**, for only the wall **64** of the mold cavity **61** should carry heating current. In FIG. **6** the inner boundary of the insulating layers **63** is shown in broken lines.

65 indicates a thermally and electrically insulating layer of asbestos, which is arranged between the outer edges of the longitudinal segments **59** and a ribbed steel frame **66**. This frame **66** withstands all external forces during the pressing operation. The longitudinal segments **59** are only subjected to pressure. The arrows **67** indicate the delivery and removal of the cooling water for the clamping bolts **62**. Insulating washers **68** of asbestos are provided at each end of each hollow clamping bolt **62**, which in addition is surrounded by an insulating tube **69** of porcelain. The electrical heating current is supplied to the graphite plates **60** through watercooled contact plates **70** of copper. The ribs **71** increase the mechanical strength of the frame **66** and facilitate the removal of heat. Cooling water flows through bores **72** in the frame **66**. The connections for supply and removal of water are not shown for the sake of clarity.

In the device shown in FIG. **8**, the mold **73** has a rectangular internal cross section and consists of two longitudinal segments **74** and two longitudinal segments **75**. These longitudinal segments **74** and **75** have all four the same length and are, in a similar manner to the longitudinal segments **50** in FIG. **5** and to the longitudinal segments **59** in FIG. **7**, assembled from graphite plates with intermediate insulation and with slots in the wall **76**/**77** of the mold cavity **80**, filled with electrically conducting carbon material. The graphite segments **74** are fastened to clamping jaws **78** and **79** respectively, which have the same length in the longitudinal direction of the mold cavity **80** as the longitudinal segments **74**. The longitudinal segments **75** are fastened to clamping jaws **81**, which likewise have the same length as the longitudinal segments **75**. The jaw **78** is fixed to a vertically arranged steel plate **82**. Two pairs of oleo-hydraulic cylinders **83** are fastened to the steel plate **82**, of which only the upper is visible. Piston rods **84** extending out of the cylinders **83** from pistons **92**, are connected to arms **85** of the clamping jaws **79** at **86** with provision for pivoting. The ability to pivot facilitates the movement of the piston rods **84** and of the arms **85**. At **87** and **88** are indicated water-cooled contact plates of copper, which are pressed against the longitudinal segments **74** or **75** with the help of water-cooled clamping bolts **89** and **90** of steel tube. These clamping bolts **89** and **90** correspond to the clamping bolts **62** in FIG. **7** and are electrically insulated in similar manner.

In the pressing condition, a chamber **91** of each cylinder **83**, and in consequence the piston **92**, is under such oil pressure that the clamping jaw **79** is pressed in the direction towards the clamping jaw **78** against the longitudinal segments **74**, and, thanks to oblique surfaces **93**, presses the clamping jaws **81** against the longitudinal segments **75**. In this pressing condition, the rectangular mold cavity **80** can be filled with the material to be hot pressed, in powder form, and put under pressure by introduction of press plungers of graphite, not shown, from above and below.

At the end of the hot pressing, the oil pressure in the cavity **91** of each cylinder **83** is removed and a cavity **94** is put under oil pressure. A consequent small longitudinal movement of the pistons **92** is sufficient to loosen the assembly of the longitudinal segments **74** and **75** of the mold **73** so far that the hot-pressed body can be removed easily, and without friction on the inner walls **76** or **77** of the longitudinal segments **74** or **75**.

For the supply and removal of current and cooling water similar means are used as have been explained with reference to the examples according to FIGS. 3 and 4, FIG. 5 and FIGS. 6 and 7.

FIGS. **9** to **11** show a device with an adjustable mold **95**, which has a square internal cross section. This mold **95** consists of four longitudinal segments **96**, which are so movable that the mold cavity **97** maintains its cross sectional shape (here square) both upon pulling apart and also pushing together of the longitudinal segments **96**. This is made possible by the arrangement of flat sliding surfaces **98**, which are parallel to the corresponding surfaces of the wall **99** of the cavity, and perpendicular to the axis of the mold. On pulling apart and on pushing together of the segments **96**, corner points **100** of the cavity cross section move along diagonals **101**. The mold cavity **97** is defined by four inserts **102**, while main parts **103** of the segments consists of steel. Between each insert **102** and the corresponding steel part **103** there is arranged a 5 mm thick layer **104** of asbestos board as electrical insulation. At **105** there is shown a clearance, which has the purpose of avoiding sliding over one another of highly heated graphite surfaces upon pulling apart and pushing together of the mold segments **96**. The arrows **106** (FIG. **9**) indicate the movement of the longitudinal segments **96** during pushing together and the arrows **107** (FIG. **10**) during pulling apart. At **108** is indicated a frame, shown schematically; it withstands the mechanical loads, and carries guides for the movement of the longitudinal segments **96**.

FIG. **11** shows primarily the construction of the inserts **102**. These inserts are built up of twelve graphite plate segments **109**. The graphite plates **109** are electrically insulated from one another by 0.2 mm thick layers **110** of flame-sprayed aluminum oxide. The layer **110** ceases at a distance of 5mm from the inner wall 99 of the mold **95**. The slots **111**, which remain upon assembly of the inserts **102**, in the wall 99 of the mold cavity **97**, are filled with a carbon material having good electrical conductivity, in the same way as the slots **41** in FIG. **4**.

The insert **102** is supported through the insulating layer **104** of asbestos, against the steel part **103**. This steel part **103** is cooled by water which flows in passages **112**. It is extended at each end of the mold to a yoke **113** with an oblique surface **114**. A water-cooled wedge **115** of copper cooperates with the oblique surface **114**, and, through a tension screw **116** and nut **117**, clamps the graphite plates **119** together in the longitudinal direction of the mold. The wedges **115** serve also as electrical current connections. For this reason they are electrically insulated from the yoke **113** by an asbestos layer **118.** After passing through the graphite plates **109** at each end of the insert **102,** the electrical current flows only through a small layer of the part of the graphite insert **102** forming the wall of the mold cavity **97.**

FIG. **12** shows diagrammatically, partly in broken lines, the mold **95** according to FIGS. **9** and **10,** with omission of the frame **108,** the two front longitudinal segments **96** and the clamping yoke **113.**

FIG. **13** shows schematically in plan a mold **119** of polyhedral internal cross section with six longitudinal segments **120** in pulled apart position, and FIG. **14** shows this mold in pushed together position. Constructionally, the longitudinal segments **120** are substantially the same as the longitudinal segments **96** of FIG. **12.** A frame is indicated at **121.**

In conventional pressing (see FIGS. **1** and **2**) the principal reason for destruction of the graphite mold is that, upon cooling, the graphite shrinks more quickly than the hot-pressed ceramic workpiece, and hence tension loads arise in the graphite which may lead to fracture of the mold. In the molds shown in FIGS. **5** to **14,** the graphite layers shrink away from the workpiece, so that no tension arises in the graphite and consequently no breakage arises.

FIG. **15** illustrates in vertical section schematically the employment of mold **122** as a stationary mold, while two press plungers **123** compress a mass **124** to be deformed. The arrows **125** indicate the pressing direction.

If the device according to FIG. **15** is provided with an opening mechanism which permits pulling apart of the mold **122,** the mold exhibits in addition the advantage that it can be opened for removal of the pressed body, so that violent knocking out is not necessary. A further advantage then lies also in the possibility of choosing the cross section of the mold cavity at any desired size between open and closed position. Upon changing the cross section of the mold by moving the segments of the mold, it is necessary to exchange the plungers **123** for others of appropriate cross section.

The compression of fine granular ceramic materials in the devices according to FIGS. **3** and **4,** FIG. **5,** FIGS. **6** and **7,** and FIG. **8** can only take place in the same way as in the devices according to FIGS. **1** and **2,** that is to say with the help of press plungers of graphite, which are introduced at each end of the mold cavity into the latter under pressure. Such a compression by plungers can also be carried out with the devices according to FIGS. **9** to **12** and FIGS. **13** and **14.** With the devices according to FIGS. **9** to **12** and FIGS. **13** and **14** the compression can however alternatively take place by simultaneous pressing together of the longitudinal segments **96** (FIGS. **9** to **12**) or **120** (FIGS. **13** and **14**). This produces a quasi-isostatic pressing action.

A purely isostatic pressing is the deformation of a body under equal pressure from all sides, for example the deformation of a sphere to a smaller sphere. In practice, however, the term "isostatic pressing" is also used in respect of the deformation of a cylinder to a cylinder of smaller diameter and equal length. The term "quasi-isostatic pressing" is used in this specification to mean the deformation of a prism of polyhedral cross section to a prism of geometrically corresponding but smaller cross section.

FIG. **16** illustrates in vertical section, schematically the employment of a mold **126** as a quasi-isostatic pressing mold. After introduction of the mass of material **127** to be hot pressed, the mold **126** is closed at both ends by graphite parts **128.** After the closing of the mold **126** the electrical current is switched on and the mold wall **129** of the mold **126** is brought to a high temperature, e.g. to 1,800° C. Before this temperature is reached, the longitudinal segments of the mold **126** are pressed towards one another by conventional means not shown in FIG. **16,** under a pressure of about 100 atmospheres. Upon attainment of a temperature at which the material **127** transforms itself into a plastic condition, the longitudinal segments of the mold move further together, until a balance occurs between pressing pressure and compressibility. - The electrical heating current is switched off after attainment of the desired temperature. After cooling, the mold **126** is opened (that is to say its longitudinal segments are pulled apart) and the pressed body is removed.

The force required to keep the parts **128** closed during pressing is very slight, because the axial pressure component produced during the closing movement of the longitudinal segments of the mold **126** is very small, by reason of the small plasticity of the material **127.**

In conventional presses according to FIG. **1** or FIG. **2,** as well as in presses according to the example according to FIGS. **9** to **11,** the compression of the material to be worked on must take place over the length of the mold cavity, since the cross section of the mold cavity remains constant. The press plungers require to perform strokes of substantial length, and are thus themselves of substantial length. As they are graphite they are extremely subject to breakage. Moreover there are pronounced density and pressure gradients in the compressed material due to the long strokes.

On operation with the mold according to FIG. **16** on the contrary, the pressing takes place by reduction of the cross section of the mold cavity with maintenance of its length. This pressing is here called quasi-isostatic, becuase of the six walls of the mold cavity four take active and simultaneous part in the deforming operation and at the same time only travel a short stroke. If a cube a^3 is produced from a parallelepiped $2a.a^2$ with a compression ratio of 2:1 by pressing, then with the conventional method the press stroke is $2.a/2$ (each plunger moves a stroke of $a/2 = 0.5a$). In production of a cube a^3 by quasi-isostatic pressing in the sense indicated above, the starting shape is a parallelepiped with a cross section $\sqrt{2}.a \times \sqrt{2}.a$ and a heigth of a; in this case the mold segments make four individual strokes of $(\sqrt{2}-1)a/2$, that is of about only $0.2a$ compared with $0.5a$ with conventional deformation.

The greatest advantages of the hot pressing device according to FIG. **16** lie on the one hand in that the pressed bodies have a nearly isotropic structure, and on the other hand in the possibility of pressing long relatively thin bodies, the physical properties of which are constant over their entire length. These cannot be produced in equally high quality by any other method.

As in all devices for hot pressing of fine granular ceramic materials, the graphite parts, where such are used, must be protected by protective gas from oxidation. For this purpose the entire hot pressing device, with the exception of the machine frame and the hydraulic cylinders fixed to it, is best brought within a steel housing through which flows a protective gas. Nitrogen is suitable as the protective gas. Argon is safer, because it is entirely inert. Helium comes less into question by reason of its high price. Hydrogen should only be used when very strict safety precautions can be met against danger of explosion.

What I claim is:

1. A device for hot pressing of ceramic materials in powder form or fine granular form, comprising a mold defining a longitudinal cavity and built up of graphite plates arranged in succession along its length, each plate lying perpendicular to the wall of said mold cavity, at least one relatively thin layer between each plate and the next, said layers being resistant to high temperature, electrically insulating, and ceasing at a distance from the wall of said mold cavity, and electrically conducting carbon material filling the slots thus resulting in the wall of said mold cavity, means for electrically heating said mold, and opposed press members adapted to enter said longitudinal cavity for hot pressing ceramic materials therein.

2. A device according to claim **1**, the electrically insulating layers ceasing at a distance not less than 1 mm and not greater than 5 mm from the wall of the mold cavity.

3. A device according to claim **1**, in which the mold is divided into longitudinal segments, and surrounding these longitudinal segments there is a frame which is able to withstand the forces which emanate from the mold cavity during use of said device.

4. A device according to claim **1**, in which the mold cavity has a polyhedral cross section and in which device the mold is divided into longitudinal segments having sliding surfaces which are parallel to the corresponding surfaces of said cavity and perpendicular to the axis of said mold, said segments being so movable along said sliding surfaces that the said mold cavity maintains its cross sectional shape both on pulling apart and also pushing together said longitudinal segments and in which mold, surrounding the said longitudinal segments, there is a frame which is able to withstand the forces which emanate from said mold cavity during use of the device.

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