

PROCESS FOR SINTER CLADDING METAL SUPPORTS

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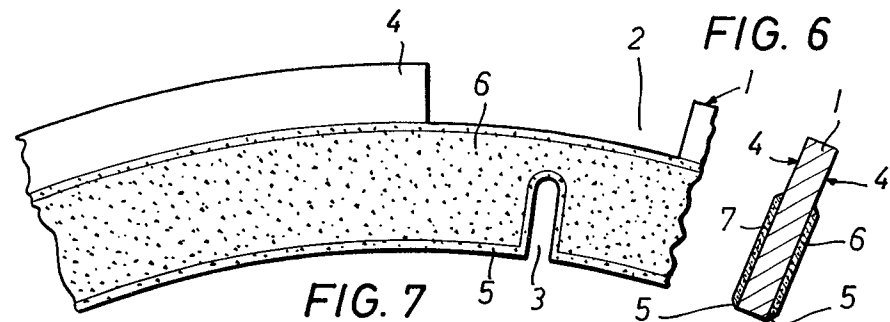
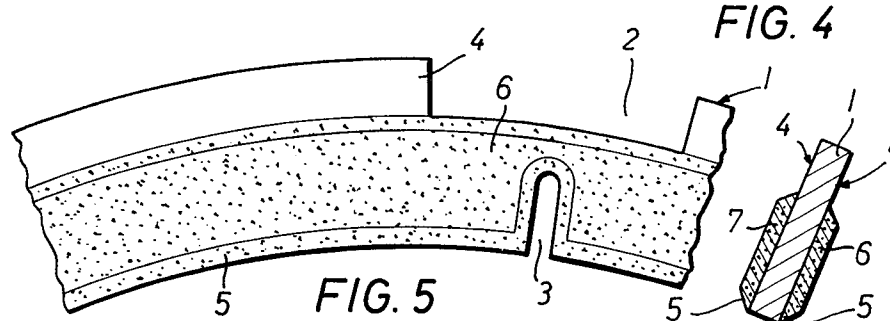
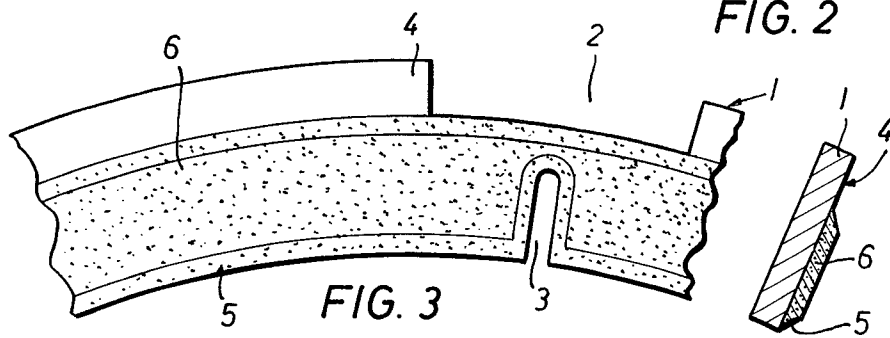
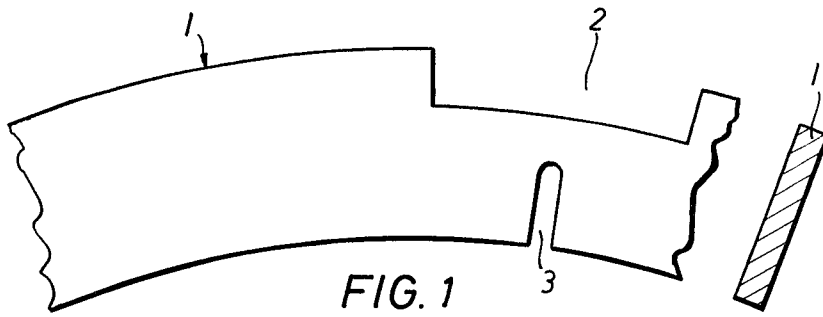


FIG. 8

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**PROCESS FOR SINTER CLADDING
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7 Claims

ABSTRACT OF THE DISCLOSURE

A process for sinter cladding metal supports such as clutch plates comprises applying a layer of sintering powder to the surface of the metal support, sintering the layer of powder to the support, compressing the sintered layer to a pre-determined porosity and then sintering the layer again. The layer of powder applied to the metal support is between three and four times the thickness of the layer after the second sintering operation and the compression of the partially sintered layer takes place between press tools which do not confine the sides of the layer since, after the first partial sintering operation, there is little or no tendency for the partially sintered layer to spread sideways as it is compressed. The fully sintered layer is preferably subjected to a second compression by means of flat press tools as a final sizing operation.

This invention relates to processes for sinter cladding metal supports, for example for applying friction pads to one or both sides of clutch or brake plates.

In the usual process for sinter cladding metal supports, the powder is first of all compressed into the shape of the layer or pad, and this is then sintered to the support. A process is also known in which the powder is sprinkled directly on to the metal support, which has previously been given a roughened or otherwise processed surface, the layer of powder being then compressed and finally sintered on the support.

The disadvantage of these methods is that before any sintering takes place the layer of powder must first of all be compressed, either by itself or resting on the support. This compressing operation requires the use of press tools which enclose the powder, and sometimes also the support, from all sides. A press tool of this kind can be used for only a single product, that is to say its dimensions are suitable for only one particular product. Using the known processes it is therefore necessary to keep in stock a large variety of different and costly press tools.

Furthermore with the first method a difficulty arises in attempting to prepare a pad of compressed powder less than 0.6 mm. thick, because it breaks too easily when it is being removed from the press tool and applied to the metal support. Furthermore these pads of compressed powder often show local differences in density, because with decreasing thickness of the pad it becomes more difficult to obtain an even distribution of the powder in the press tool. In attempting to overcome these difficulties the initial pad of compressed powder has been made comparatively thick, and after sintering to the metal support the excess thickness has been removed by grinding. The grinding operation is not only uneconomical but also, in

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the manufacture of friction pads, tends to tear the non-metal components of the sintered layer, particularly graphite, out of the surface of the pad. Furthermore grinding wastes a considerable amount of material.

A further disadvantage of the known processes is that the surface of the metal support is often insufficiently reduced chemically, and the residual surface oxides do not give a firm bond between the support and the pad. To avoid this difficulty the steel support may be copper-plated or nickel-plated before applying the pad of compressed powder, or before applying the powder directly. This again increases costs. Finally, particularly in the manufacture of clutch plates, it is often desired to introduce slots or grooves, and these are milled in or ground in after sintering. Apart from the extra manufacturing operations involved, and the loss of material, the surfaces and edges of the grooves and slots are rough and loosened by the cutting operations.

The object of the present invention is to avoid these disadvantages, and in particular to provide a sintering process which enables layers of between 0.1 mm. and 1.5 mm. thick to be applied to the support. To this end, according to the invention, in the sinter cladding of metal supports sintering powder is applied to the surface of the support to form a layer, the layer of powder is sintered to the support, the sintered layer is compressed to a pre-determined porosity and the layer is then sintered again.

If desired the support can have a sintered layer applied to both sides before compression. The great advantage of the process in accordance with the invention is that the compressing can be done using press tools which are open at the sides and do not have to be made to suit the dimensions of the support. The compression is applied to a layer of powder which has already been sintered to a certain degree, and which therefore cannot escape sideways out of the open press tool, as happens when an unsintered powder is compressed.

A further advantage of the process in accordance with the invention is that there is no loss of material, the weight of the finished layer being the same as the initial weight of the layer of powder. Furthermore, during the compressing of the presintered layer a certain residual porosity is retained, serving to compensate for thickness variations in the metal support and in the layer. The finished product therefore has a layer of even thickness. Furthermore, the compressing does not distort the support, and this is a great advantage in particular when applying sintered layers to precisely dimensioned toothed parts for installation in machines.

The layer of powder, applied to the support is several times thicker, preferably three to four times thicker, than the compressed layer after the second sintering operation. The thickness of the layer after the first sintering operation remains about the same as the initial thickness of the layer of powder. An important advantage arises here in that during sintering in a reducing atmosphere the reducing furnace gases flow through the loose layer of powder and reduce any residual oxides on the surface of the metal support. In this way a good bond is obtained between the support and the sintered layer. This cannot be obtained by the customary methods.

Finally there is the advantage that in compressing the

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layer after the first sintering operation when it still has a considerable porosity, the pressure required is only a little more than that required for compressing a layer of entirely unsintered powder of the same composition. Furthermore the compressing can be done much faster, because there is no danger of occluded air blowing the particles out sideways, as can happen when a layer of loose powder, that is to say entirely unsintered powder, is compressed. Moreover, high pressing speeds allow considerably lower press thrusts to be used than do lower press speeds.

During the compression of the layer after the first sintering operation, the material adapts its shape particularly well to the surface shape of the press tool, and consequently spiral or radial grooves and other depressions can be pressed into the surface of the layer without difficulty. The material is displaced sideways only to a small extent, because the sinter bridges in the layer of material are retained. The layer acquires a high mechanical strength and this can be still further increased by a further sintering operation. The grooves can be pressed in simultaneously on both sides when sintered layers are applied to both sides of the support, whereas when grooves are cut by a machining operation this can never be done simultaneously on both sides, and moreover it necessarily involves loss of material. Grooves pressed in are free from rough edges, in contrast to cut grooves.

The edges of the layer are formed during the application of the powder by the shape of the support, and if necessary by means of masks which keep the powder away from particular locations on the support, for example from teeth, projections and the like. By the process according to the invention powder can for example be applied to a support which is already slotted or pierced, the powder merely falling through the slots and other openings, so that the layer of powder ceases at the edges of the openings.

The second sintering, after the compression, can be performed simultaneously on a stack of supports under a superimposed load. This method at the same time eliminates any warping present in the support, by a thermal flattening process. After the second sintering operation the product may be finished by pressing under a flat tool, to eliminate tolerance deviations. These can be eliminated in the customary process only by means of a costly grinding operation. A particular advantage is that pressed in grooves or other depressions can easily be further compacted by means of flat press tools. The density of the sintered layer can be increased by about 10% in this way. The final compressing of the layer to the specified dimensions further increases the resistance of the layer to abrasion.

In those cases where it is desired to use the process according to the invention in the application of thicker layers to supports, the sloping edges of the layers of applied powder can be a disadvantage. In these cases the layer of sintering powder is applied to the support by sprinkling the powder into a mould to a depth greater than the depth of the mould, the powder in the mould is compressed by applying the support to it and then the mould and support are inverted and the mould is removed leaving the layer of compressed powder on the support.

A process in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGS. 1 to 8 show successive steps in the process in which in this example consists of the application of a friction pad to a steel plate. FIGS. 1, 3, 5 and 7 are side views of a part of the plate, and FIGS. 2, 4, 6 and 8 are corresponding cross-sections.

A plate 1 has a wide slot 2 and a narrow slot 3. A quantity of sintering powder is first of all sprinkled on to a part of the surface, using a mask to keep a margin 4 free of powder, as shown in FIGS. 3 and 4. The edges of the powder layer 6 are bevelled at 5. If the powder

layer is less than 0.6 mm. thick the bevelled edge plays practically no role. In the case of a thicker layer of powder the bevelling can if desired be prevented by means of a mould. The thickness of the powder layer 6 is approximately two to three times greater than the thickness of the final friction pad as shown in FIGS. 7 and 8.

After the powder has been sprinkled on to the surface of the plate 1 shown in FIGS. 1 and 2, it is sintered to the other side of the steel plate 1 can be provided with a porous sintered layer 7 in the same way, as shown in FIGS. 5 and 6. After the first sintering operation, the assembly is pressed using flat press tools. This reduces the thickness of the sintered powder layers to between half and one-third of the initial thickness. The layers are then sintered a second time, and are then subjected to a finish pressing operation to give the required thickness with precision, again using flat press tools, this operation involving an increase in the density of the sintered pads.

The sintering temperatures depend on the nature of the sintering powder or mixture of powders used, and are already well known.

I claim:

1. A process for producing clutch or brake plates formed of a metal support having slots or the like formed therein and being sinter clad with a pad of friction material on both sides thereof, which comprises the steps of applying a layer of sinterable powder having a high coefficient of friction on a partly uncovered surface of one side of the metal support, sintering the particles of the layer of powder to one another and to the support, compressing the sintered layer to a predetermined porosity, and again sintering the layer, and after the steps of applying the layer of sinterable powder on the partly uncovered surface of said one side of the metal support and sintering the particles of the layer of powder to one another and to the support, the steps of turning the plate over on the other side thereof, applying a second layer of sinterable powder on a partly uncovered surface of the other side of the metal support and sintering the particles of the second layer of powder to one another and to the surface of the other side of the support, and thereafter the steps of simultaneously compressing both of the sintered layers to predetermined porosity and again sintering both of the layers simultaneously, and finally compressing the resulting body to produce a finished plate.

2. A process as claimed in claim 1, wherein the thickness of said layer of powder formed on both sides of said support is between three and four times the thickness of said layer after said second sintering operation.

3. A process as claimed in claim 1, wherein said steps of compressing said layers comprises confining a central portion of said layers between press tools while leaving the side edges of said layers unconfined.

4. A process as claimed in claim 1, further including the step of forming depressions in said layers simultaneously with the step of compressing said layers to said predetermined porosity.

5. A process as claimed in claim 1, further comprising the step of stacking a plurality of supports on which layers of sinterable powder have been applied, sintered and compressed, and sintering said layers on all said supports simultaneously in said stack while applying a superimposed loading to said stack.

6. A process as claimed in claim 1, wherein said step of applying said layers of sinterable powder to said surface of said support includes the subsidiary steps of sprinkling said powder into a mould to provide a depth of powder greater than the depth of said mould, applying said support to the surface of said powder and moving said support downwards to compress said powder, inverting said support and mould and removing said mould to leave said compressed powder on said support.

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7. A process as claimed in claim 1 wherein the first sintering of the layer of powder on both sides of the metal support is at minimal pressure so that virtually no loss in thickness of the layer of powder is produced thereby.

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