

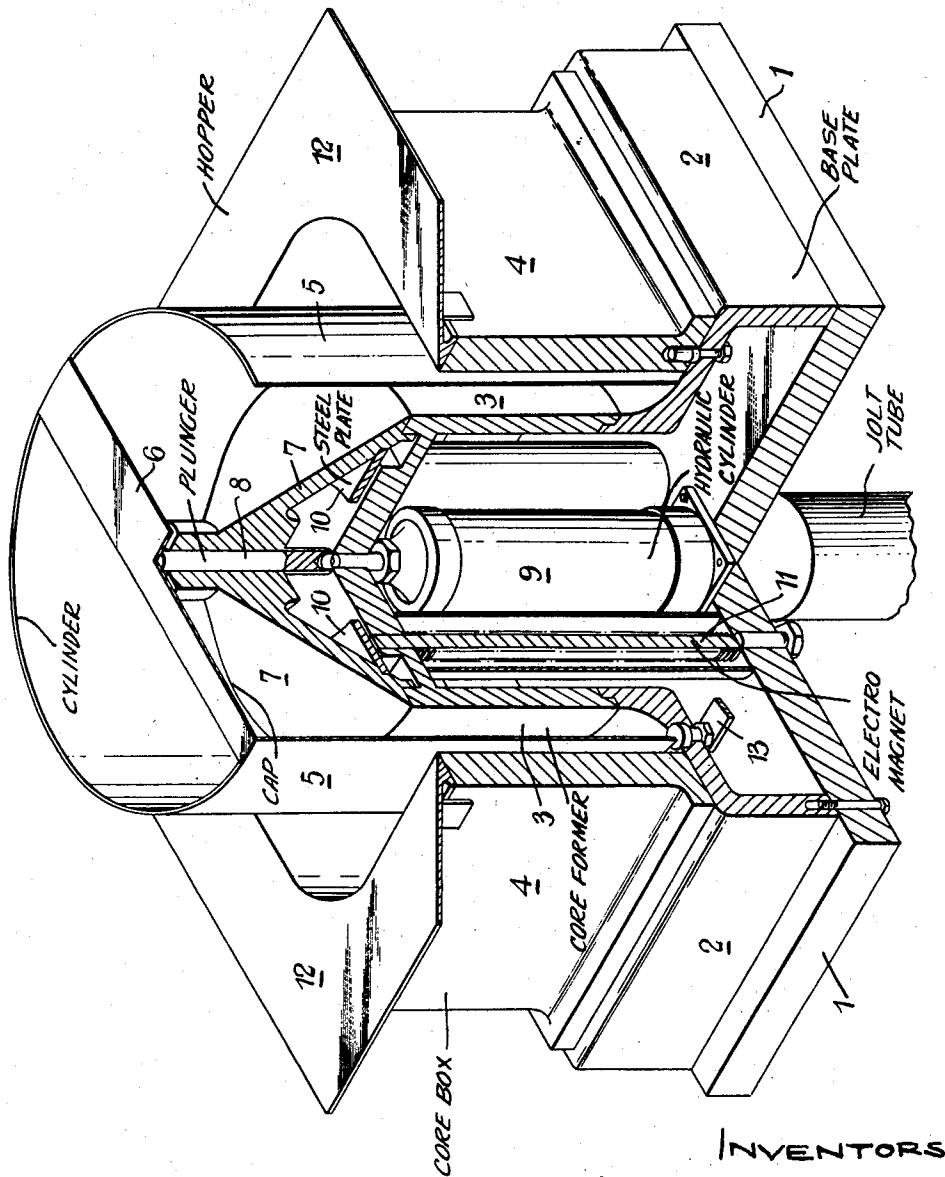
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PRODUCTION OF MULTILAYER COMPACTED GRANULAR PRODUCTS

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PRODUCTION OF MULTILAYER COMPACTED GRANULAR PRODUCTS

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This invention relates to processes and apparatus for the production of multilayer products in which each layer is formed of compacted granular material.

It is of particular value in the production of materials for foundry use and more particularly in the production of multilayer sleeves and the like used as linings for hot top boxes, the heads of ingot moulds and the like. It will therefore be described with special reference to this especial application.

It is known practice in the production of metal castings or ingots to locate an exothermic mixture, usually comprising aluminium and an oxidising agent, as a lining for the riser cavities, feeding head cavities or head boxes. A particularly valuable type of exothermic mixture for the purpose is described in United States Patent No. 2,591,105 and consists of aluminium, a quantity of oxidising agent insufficient to oxidise all the aluminium and a proportion of 1 to 5% of a fluoride, usually also with a filler. Many other exothermic mixtures have been proposed, e.g. mixtures similar to those of the said patent in which the proportion of fluoride may be as little as 0.5% or as much as 10% or even more, and the mixtures described in British Patents Nos. 774,490, 774,491, 769,719, 775,380 and 772,273.

The usual practice is to pre-form the exothermic mixture to a desired shape, e.g. a sleeve, and to dry it by a stoving operation. To reduce loss of heat it has also been proposed to provide duplex materials of this type in which the exothermic material is backed by a layer of refractory or heat-insulating material.

The present invention is concerned with an improved method of forming such multilayer materials. A most convenient backing material is sand and the invention will be described with particular reference to the use of sand, though it is to be understood that it is not so limited.

Currently there are two main techniques employed in the production of duplex materials of the type referred to. In one method the sand is rammed into a space to the desired shape, a lining of exothermic material is then applied and the whole assembly is stoved. In this method a good anchorage is achieved between the sand and the exothermic material but the method is difficult since it necessitates handling the sand shape in its "green" (i.e. unstoved) condition.

Alternatively, therefore, the sand shape can be stoved before the exothermic layer is applied but whilst this avoids the necessity of handling the green and shape it results in less efficient anchorage between the layers.

According to the present invention there is provided a process for making a product comprising at least two layers formed of compacted granular material, the layers being united at their interface, which comprises feeding the materials which are to form two said layers separately into adjacent compartments separated by a removable thin partition, compacting each in its own compartment by a jolting action, removing the said partition and continuing the said jolting action until the materials of the two layers become united at their interface.

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In this way duplex shapes of sand and exothermic materials are obtained in which the anchorage of the layers is exceptionally good but there is no need for separate handling of the green sand shape.

According further to the present invention there is provided apparatus for the production of products comprising two layers of compacted granular material united together at their interface which comprises a chamber, a thin removable partition dividing said chamber into two compartments, a jolting device for jolting said chamber and means for withdrawing the said removable partition while continuing the jolting action.

The method and apparatus of the invention will now be illustrated with reference to the production of a duplex sleeve, i.e. one consisting of two contacting concentric cylinders, e.g. of sand and exothermic material respectively, anchored together at their interface.

Suitable apparatus for carrying out the method is illustrated in the accompanying drawing, it being understood that the apparatus stands on the platform of a jolting machine.

Referring to this drawing the apparatus comprises a base plate 2 (which rests on the said platform 1). Formed with the base plate 2 is an upstanding hollow core former 3. Mounted concentrically with the core former 3 is a core box 4. In the annulus between the core former 3 and the core box 4 is a removable thin-walled cylinder 5. This is connected by a cross bar 6 at its upper open end to a cap member 7 adapted to fit over the upper open end of the core former 3 and is further connected to a plunger 8 of a fluid-operated, e.g. hydraulic or pneumatic, cylinder 9. The cap member 7 is provided with a steel plate 10 and there are also provided electro-magnets 11 fed with currents via bus-bar 13 and co-operating with the plate 10. A detachable hopper 12 is connected to the upper edge of the core box 4.

The method of operation is as follows. The apparatus is assembled as shown and the current to the electro-magnets is switched on. These, by attracting the steel plate 10, hold the cap 7 and the cylinder 5 in position as shown in the drawing. Sand is fed via the hopper 12 to fill the annular space between the core box 4 and the cylinder 5. Simultaneously exothermic composition is fed into the open end of the cylinder 5, passes over the cap 7 and fills the annulus between the core former 3 and the cylinder 5.

During the filling operation the jolting table is maintained in motion so that the materials compact in their separate adjacent annuli. It is usually found desirable to stop the jolting action after a period, to allow the annuli to be "topped up," i.e. additional material added to make up for the loss of volume due to the compacting of the materials.

Then, with the jolting action maintained, the current to the electro-magnets is switched off and the valve to the cylinder 9 is opened to cause the plunger 8 to move upwards. This is effected slowly, so that the cylinder 5 is only slowly withdrawn from its position between the compacted layers in the adjacent annuli. The continued jolting causes the two compacted layers to merge together at their interface. If necessary or desirable additional sand and exothermic material may be fed in to take up the small drop in level which results from the sand and exothermic material filling the space previously occupied by the thin metal cylinder 5.

When the cylinder 5 is wholly withdrawn it is removed, together with the cap 7 and the hopper 12 leaving a flat surface formed by the upper edges of the core former 3, the core box 4 and the intervening double layer of compacted material. This latter is smoothed off, a board laid over it and the whole assembly then inverted (rolled over) so that the composite sleeve thus formed of

the compacted materials is separated, resting on the board. It may then be stoved to impart to it desirable properties of rigidity.

Since the sand and exothermic material are simultaneously stoved a good anchorage between them is achieved. Moreover, the method has the advantage of speed since the two layers of the sleeve are formed simultaneously and not in succession as in previous methods.

It is to be understood that while the invention has been described with reference to the production of a duplex sleeve, it may also be applied to the production of such two layer assemblies in other shapes, including the production of flat or curved duplex slabs or tiles and, by the provision of an appropriate number of partitions, to the production of products having more than two layers.

We claim as our invention:

1. Apparatus for the production of hollow cylindrical products comprising two annular layers united together at their interface which comprises a hollow cylindrical core former and a core box of hollow cylindrical inner configuration defining an annular space therebetween, a removable thin cylindrical partition within said annular space whereby said annular space is divided into two adjacent annular spaces, a cover for the open end of said core former connected to said thin cylindrical partition, separately operable releasable means within the core former for holding the said cover close on said core former and for raising said cover and concomitantly said cylindrical partition, means for feeding separate granular materials into the said two annular spaces and means for jolting the whole apparatus continuously.

2. Apparatus for the production of hollow cylindrical products comprising two annular layers united together at their interface which comprises a hollow cylindrical core former and a core box of hollow cylindrical inner configuration defining an annular space therebetween, a removable thin cylindrical partition within said annular space whereby said annular space is divided into two adjacent annular spaces, a cover for the open end of said core former having magnetisable material therein, electro-magnetic means within the core former for co-operation with said magnetisable material to hold the said cover close on said core former, separately operable fluid-operated pressure apparatus for raising said cover and concomitantly said partition, and means for jolting the whole apparatus continuously.

3. Apparatus for the production of hollow products comprising two annular layers united together at their interface, which comprises a hollow core former and a core box of hollow inner configuration having an annular space therebetween, a removable thin partition within said annular space whereby said annular space is divided into two adjacent annular spaces, a cover for the open end of said core-former connected to said thin partition, separately operable releasable means within the core-former for holding the cover close on said core-former and for raising said partition, means for feeding separate granular materials into the said two annular spaces and means for jolting the whole apparatus continuously.

4. Apparatus for the production of hollow products

comprising two layers united together at their interface, which apparatus comprises, in combination, a hollow core-former and a core box of hollow inner configuration defining an annular space therebetween, a removable thin partition within said annular space dividing the same into two adjacent annular spaces, a cover for the open end of said core-former, means within the core-former for releasably holding the cover close on the core-former, means supporting said partition on said cover, means for feeding separate granular materials into said two annular spaces, means within said core-former engageable with said supporting means for raising said partition, and means for jolting the whole apparatus continuously during the feeding of said materials and the raising of said partition.

5. Apparatus for the production of hollow cylindrical products comprising two layers united together at their interface, which apparatus comprises, in combination, a hollow cylindrical core-former and a core box of hollow cylindrical inner configuration defining an annular space therebetween, a removable thin partition within said annular space dividing the same into two adjacent annular spaces, a generally conical cover for the open end of said core-former defining an upwardly sloping surface, means within the core-former for releasably holding the cover close on the core-former, means supporting said partition on the upper end of said conical cover, means for feeding separate granular materials into said two annular spaces, means within said core-former engageable with said supporting means for raising said partition, and means for jolting the whole apparatus continuously during the feeding of said materials and the raising of said partition.

6. Apparatus for the production of hollow cylindrical products comprising two layers united together at their interface, which apparatus comprises, in combination, a hollow cylindrical core-former and a core box of hollow cylindrical inner configuration defining an annular space therebetween, means defining a hopper on said core box, a removable thin partition within said annular space dividing the same into two adjacent annular spaces, a generally conical cover for the open end of said core-former defining an upwardly sloping surface terminating in an upper horizontal surface, means within the core-former for releasably holding the cover close on the core-former, means supporting said partition on the upper surface of said conical cover, means for feeding separate granular materials over said hopper and said conical surface into said two annular spaces, a plunger extending through said core-former and conical cover into engagement with said supporting means, means for raising said plunger and thereby said partition, and means for jolting the whole apparatus continuously during the feeding of said materials and the raising of said partition.

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