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(54) **Apparatus for use in making a sand mold.**

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Description

This invention relates to apparatus for use in making a sand mold comprising a pattern plate having a surface for supporting one surface of the mold and having an aperture communicating with a bore in a pattern, used to form the mold, and freeing means for assisting in breaking sand free from the pattern to facilitate removal of the pattern, the freeing means comprising a first member movably positioned in the bore, a second member supported in a spaced-apart relationship to the mold supporting surface of the pattern plate by a plurality of support members arranged around its periphery, and compression means positioned between the first and second members for resiliently resisting movement of the first member towards the second member, see DE—A—2,809,608.

Green sand molding is a process wherein a pattern can be formed in a sand mold without the necessity of heating or chemically treating the sand in order to form the pattern. This type of molding process encounters difficulty in deep bore patterns, particularly for example with patterns wherein the height of a bore is greater than its width. Often, when such bores are present, the sand tends to break off on the inside of the bore as the pattern is removed. In order to alleviate this problem, foundry people have either inserted a preformed core into the pattern where they desired to form a bore, or have had to add additional draft which caused excessive machining. Both of these alternatives proved to be expensive and required a great deal of time.

Many prior proposals have been made of methods for removing the finished casting from sand molds, for example using vibratory methods (as in US—A—1,704,100) or methods involving a sufficiently strong longitudinal force on the casting (as in US—A—1,960,366). When removing a casting from the mold damage to the sand mold is of no importance, and indeed frequently occurs. However, when removing a pattern piece from the mold, it is important that the sand mold remains intact so that a good casting can be formed. Thus these known methods of removing the casting are unsuitable for removal of the pattern piece from the mold before the mold is put to use.

US—A—3,238,576 discloses apparatus for making a sand mold, in which a resilient pad is placed at the bottom of a deep bore in the pattern plate. The pad is compressed as sand is formed into the bore. When the sand is lifted, to strip it from the pattern, the upward pressure exerted by the resilient pad ensures that the sand in the bore does not break off from the main body of sand.

DE—A—2,809,608 discloses apparatus having freeing means which comprise a piston upwardly biased by a spring and projecting through a hole in the mold supporting surface of the pattern plate, into the bottom of a bore in the pattern. The force pressing the sand into the bore downwardly deflects the piston, compressing the spring. On removal of the force, the piston, upwardly biased by the spring, helps to break the sand free from the inside of the bore, thereby facilitating removal of the pattern and pattern plate.

The object of the present invention is to provide apparatus of the type disclosed in DE—A—2,809,608, having improved freeing means which ensure better guiding of the piston.

This invention provides apparatus characterised in that the aperture and first member have substantially the same cross-sectional dimensions as the bore and are in line with the bore, the first member has a plurality of apertures around its periphery corresponding to the plurality of support members and through which the support members pass, and the compression means comprise a pluralilty of coil springs carried by respective support members.

The invention will be described in more detail by way of example, with reference to the drawings, in which:

Fig. 1 is a side view of apparatus for use in making a sand mold and showing some but not all features of the invention;

Fig. 2 is a top view of Fig. 1 along line 2—2; and

Fig. 3 is a side view of an embodiment of this invention.

In use the molding sand is pressure packed into the mold, about the pattern and into the bore. The pressure both compacts the sand around and within the pattern and causes the first member to be depressed against the compression means. Subsequently the pressure is released and the pattern plate is removed. When the pressure is released the compression means forces the first member up into the bore to break the sand free from the deep bore pattern to a sufficient extent to facilitate removal of the pattern.

Referring to Figs. 1 and 2, an apparatus 10 is shown for breaking sand 12 free from a pattern 14 having a deep bore 16. The deep bore 16 can have almost any shape but most commonly will be a tubular structure wherein the height of the bore is greater than the width.

For purposes of discussion only and not by way of limitation, the apparatus 10 will be explained as being positioned in the horizontal plane with movement in the vertical plane, as illustrated.

The apparatus 10 is attached to a pattern plate 18 which contains an aperture 20 which shares the same central axis as that of the deep bore 16. The aperture 20 is of the same shape and has the same cross-sectional dimensions as the deep bore 16.

The apparatus 10 includes a first movable member 22, a second fixed member 24, and compression means 26. The first member or

stripper block 22, is positioned within the aperture 20 of the pattern plate 18 and partially extends into the opening of the deep bore 16. The exat amount that the first member 22 extends into the deep bore 16 wil depend upon the travel distance needed to break the sand 12 free from the inside surface of the deep bore 16. The first member 22 has a top surface 28 and a bottom surface 30. The top surface 28 provides a base for the sand 12 while the bottom surface 30 abuts against the compression means 26. The compression means 26, shown as a coil spring, is positioned between the first member 22 and the second member 24 and serves to yieldably resist the downward movement of the first member 22. The force required to compact the sand 12 into the deep bore 16 is sufficient to compress the compression means 26. Preferably, the top surface 28 of the first member 22 will be flush with the top surface of the pattern plate 18 when the bottom surface 30 contacts the second member 24.

The second member 24 is attached to the pattern plate 18 by support means 32, of which two are shown and serve to hold the second member 24 away from the first member 22. These support means 32 can be bolts or studs which are screwed into the pattern plate 18.

Turning to Fig. 3, an embodiment of the invention is depicted showing the apparatus 10 comprised of several additional elements. In this view, the pattern 14 is securely attached to the pattern plate 18 by machine screws 19, of which one is shown. The apparatus 10 is again attached to the underside of the pattern plate 18 in alignment with the aperture 20. The apparatus 10 is comprised of a stripper block 40 having a top surface 42 and a bottom surface 44. Attached to the bottom surface 44 by screws 46 and a pin 48 is a strip plate 50. The strip plate 50 has a larger cross-sectional diameter than the stripper block 40 and contains a number of apertures 52 located near its outer periphery. The purpose of these apertures 52 will be explained shortly.

Positioned below the strip plate 50 is a back plate 54 which has a stop block 56 fastened to it by a bolt 58. The back plate 54 is approximately the same size as the strip plate 50 and also contains a similar number of apertures 60 located near its outer periphery. The apertures 60 are in alignment with the apertures 52. Passing through each pair of corresponding apertures 52 and 60 is a support means 62 in the form of a machine bolt. The support means 62 serve to unite the strip plate 50 and the back plate 54 to the pattern plate 18 while allowing axial movement of the strip plate 50 in the vertical plane.

A collar 64 is concentrically positioned around each support means 62 between the pattern plate 18 and the strip plate 50. These collars 64 limit the upward travel of the strip plate 50. Also concentrically positioned about each of the support means 62, between the strip plate 50 and the back plate 54, is compression means 66, such as a plurality of coil springs of equal compressive strengths. The compression means 66 serve to yieldably resist the downward movement of the stripper block 40 as the sand 12 is compacted and pressed into the deep bore 16 of the pattern 14. The compression means 66 are designed to be gradually compressed by the applied force on the sand 12 until the strip plate 50 contacts the stop block 56. The stop block 56 will prevent further downward movement of the strip plate 50. After the applied pressure on the sand 12 is released and the pattern plate 18 is being separated from the mold, the compression means 66 will urge the stripper block 40 via strip plate 50 back to its initial position. This upward movement of the stripper block 40 will break the bond between the inside surface of the pattern 14 and the sand 12 thereby allowing the pattern 14 to be fully withdrawn leaving a perfect impression.

Operation

The method for making a green sand mold using a pattern having a deep bore will now be explained. In the molding operation, the pattern 14 is first mounted onto the pattern plate 18. A flask box, which is a four-sided frame, is placed on top of the pattern plate 18 and fully encloses the pattern 14. The sand 12, preferably green sand, is introduced into the flask box. This sand 12 can be vibrated or jolted along with the flask box and/or pattern plate in order to assure that all cavities and crevices get filled. The green sand 12 is such that it does not have to be heated or chemically treated in order to set but instead is formed about the pattern 14 by pressure alone. Therefore, pressure is applied to the top surface of the sand 12 and this pressure forces the sand 12 downward into and around the pattern 14, including into the deep bore 16.

With the apparatus 10 in axial alignment with the aperture 20 of the pattern plate 18, the applied force on the sand 12 will depress the first member 40 against the second member 24. This action will compress the compression means 66. The amount of pressure required to depress the first member 40 downward to a point where the top surface 42 is flush with the top surface of the pattern plate 18 will depend upon a variety of factors. Such factors include: the type of sand, the composition of the sand, the size of the pattern, the size of the deep bore, the type of equipment the sand mold is being formed on, and the shape of the deep bore. Normally, on a conventional green sand molding machine, the applied pressure is between 800 and 2000 psi (about 5500 and 14000 kPa), preferably between 1000 and 1500 (about 7000 and 10000 kPa) and most preferably 1350 psi (about 9300 kPa).

After the sand 12 has set about the pattern 14, the applied pressure is removed and the

flask box is stripped from the pattern 14. As this occurs, the first member 40 is simultaneously forced back to its initial position by the compression means 66. This action breaks the sand 12 free from the inside surface of the pattern 14 thereby allowing the pattern 14 to be fully removed from the sand mold without having the sand 12 shear off within the deep bore 16. The pattern 14, the pattern plate 18 and the apparatus 10, all three being permanently connected together, are then ready to be used over again.

The sand mold which has just been formed, is then rotated 180 degrees and is filled with molten material, for example metal. This molten material will fill the impression left in the sand 12 made by the pattern 14. The cast mold is then cooled and the sand 12 is broken away leaving the finished casting.

To assist in breaking the sand 12 free from the inner surface of the pattern 14, a slight tapered draft can be used. This tapered draft, shown on the inner wall of the pattern 14 in Fig. 1, should be about one degree and preferably about one half of a degree. It should be noted that the insertion of this slight draft may require extra machining of the finished casting if close tolerances are crucial to the finished product.

The system illustrated facilitates in the removal of a pattern from a sand mold, particularly a deep bore pattern from a green sand mold and has a number of advantages. These include a reduction in the amount of draft required on the inside of a deep bore, and the ability to form deep pockets in the cope half of molds where cores cannot be used. The system furthermore can provide both a time and cost saving over the conventional method.

Claims

1. Apparatus for use in making a sand mold comprising a pattern plate (18) having a surface for supporting one surface of the mold (12) and having an aperture communicating with a bore (16) in a pattern (14) used to form the mold (12), and freeing means (10) for assisting in breaking sand free from the pattern (14) to facilitate removal of the pattern (14), the freeing means (10) comprising a first member (40, 50) movably positioned in the bore (16), a second member (54, 56) supported in a spaced-apart relationship to the mold supporting surface of the pattern plate (18) by a plurality of support members (62) arranged around its periphery, and compression means (66) positioned between the first and second members for resiliently resisting movement of the first member (40, 50) towards the second member (54, 56), characterised in that the aperture (20) and first member (40, 50) have substantially the same cross-sectional dimensions as the bore (16) and are in line with the bore (16), the first member (40, 50) has a plurality of apertures (52) around its periphery corresponding to the plurality of support members (62) and through which the support members (62) pass, and the compression means comprise a plurality of coil springs (66) carried by the respective support members (62).

2. Apparatus according to claim 1, characterised in that the coil springs (66) are of equal compressive strength.

3. Apparatus according to claim 1 or 2, characterised by means (19) for fixing the pattern (14) to the pattern plate (18).

Revendications

1. Appareil utilisable pour la production d'un moule en sable comprenant un plateau porte-modèle (18) muni d'une surface pour supporter une surface du moule (12) et présentant un orifice communiquant avec un alésage (16) ménagé dans un modèle (14) utilisé pour former le moule (12), et des moyens de dégagement (10) pour aider à décoller le sable du modèle (14) afin de faciliter l'extraction du modèle (14), les moyens de dégagement (10) comprenant un premier élément (40, 50) disposé de façon mobile dans l'alésage (16) un second élément (54, 56) supporté dans une relation d'écartement par rapport à la surface de support du moule du plateau porte-modèle (18) par plusieurs éléments de support (62) disposés autour de sa périphérie, et des moyens de compression (66) disposés entre les premier et second éléments pour s'opposer élastiquement au déplacement du premier élément (40, 50) vers le second élément (54, 56), caractérisé en ce que l'orifice (20) et le premier élément (40, 50) ont sensiblement les mêmes dimensions en section droite que l'alésage (16) et sont alignés avec cet alésage (16), en ce que le premier élément (40, 50) présente plusieurs orifices (52) autour de sa périphérie extérieure, correspondant au nombre des éléments de support (62) et à travers lesquels les éléments de support (62) passent, et en ce que les moyens de compression comprennent des ressorts hélicoïdaux (66) portés par les éléments de support respectifs (62).

2. Appareil suivant la revendication 1, caractérisé en ce que les ressorts hélicoïdaux (66) ont même module de compression.

3. Appareil suivant la revendication 1 ou 2, caractérisé par des moyens (19) servant à fixer le modèle (14) sur le plateau porte-modèle (18).

Patentansprüche

1. Apparat zur Verwendung bei der Herstellung von Sandformen, der eine Modellplatte (18) mit einer Oberfläche zum Unterstützen einer Fläche der Form (12) und mit einer Öffnung, die mit einer Bohrung (16) in einem Modell (14) in Verbindung steht, das zur Herstellung der Form verwendet wird, und Freisetzungsmittel (10) zum Unterstützen des Freibrechens des Sandes von dem Modell (14) zur Erleichterung der Entnahme des Modells (14)

aufweist, wobei die Freisetzungsmittel (10) ein erstes Glied (40, 50), das beweglich in der Bohrung (16) angeordnet ist, ein zweites Glied (54, 56), das in einer Abstandsbeziehung zu der die Form tragenden Oberfläche der Modellplatte (18) durch eine Mehrzahl von Stützgliedern (62) getragen wird, die um seinen Umfang angeordnet sind, und Druckmittel (66) aufweisen die zwischen den ersten und zweiten Gliedern angeordnet sind, um der Bewegung des ersten Gliedes (40, 50) in Richtung auf das zweite Glied (54, 56) nachgiebig Widerstand zu leisten, dadurch gekennzeichnet, daß die Öffnung (20) und das erste Glied (40, 50) im wesentlichen die gleichen Querschnittsabmessungen wie die Bohrung (16) aufweisen und in Fluchtung mit der Bohrung (16) angeordnet sind, daß das erste Glied (40, 50) eine Mehrzahl von Öffnungen (52) um seinen Umfang aufweist, die mit der Mehrzahl von Stützgliedern (62) korrespondieren und durch welche die Stützglieder (62) hindurchgehen, und daß die Druckmittel eine Mehrzahl von Schraubenfedern (66) umfassen, die durch die entsprechenden Stützglieder (62) getragen werden.

2. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß die Schraubenfedern (66) von gleicher Kompressionsfestigkeit sind.

3. Apparat nach Anspruch 1 oder 2, gekennzeichnet durch Mittel (19), um das Modell (14) an der Modellplatte (18) zu befestigen.

FIG. 2

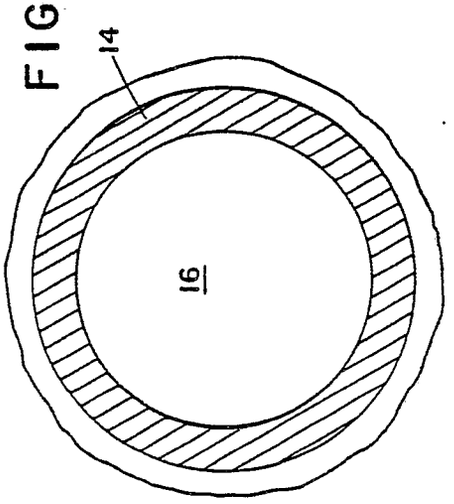
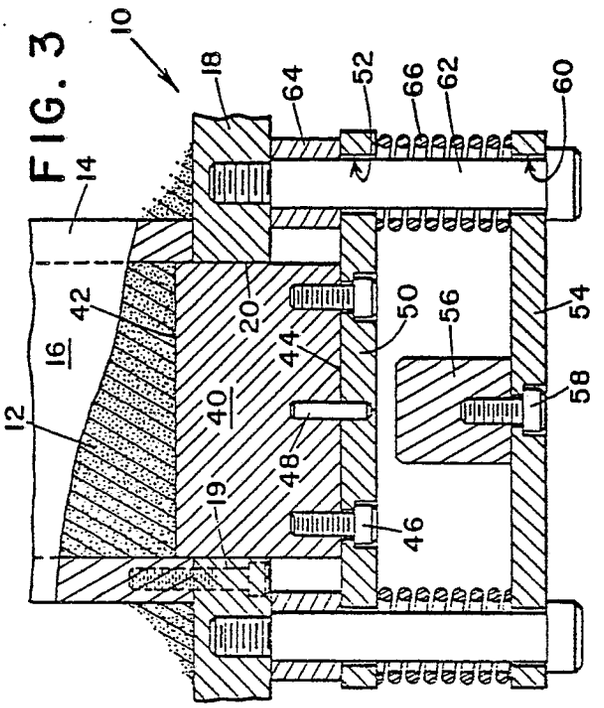


FIG. 3



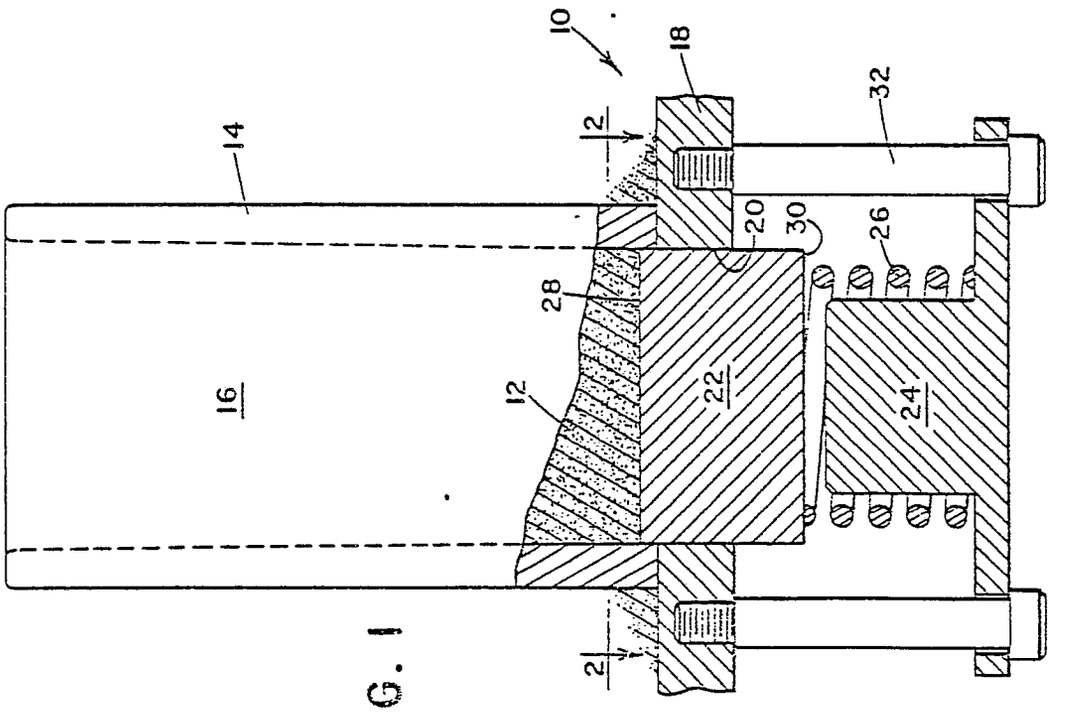


FIG. 1