# United States Patent

[11] **3,570,585**


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[73] Assignee **Caterpillar Tractor Co.**
**Peoria, Ill.**


[54] **PATTERN FOR MAKING MOLD WITH A BACK DRAFT**
**9 Claims, 12 Drawing Figs.**


[52] **U.S. Cl.** ..... **164/245,** 164/45, 249/183
[51] **Int. Cl.** ..... **B22c 7/00**
[50] **Field of Search** ..... 164/245, 249, 248, 246, 235—244, 41, 45, 138, 364—370, 228—231, 11, 12, 13, 54, 86, 91, 93, 94, 98, 99; 249/183, 134, 135



[56] **References Cited**
UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 396,506 | 1/1889 | Palmer | 164/248 |
| 1,769,455 | 7/1930 | Pickering | 164/369 |
| 3,216,071 | 11/1965 | Schaible | 164/245X |



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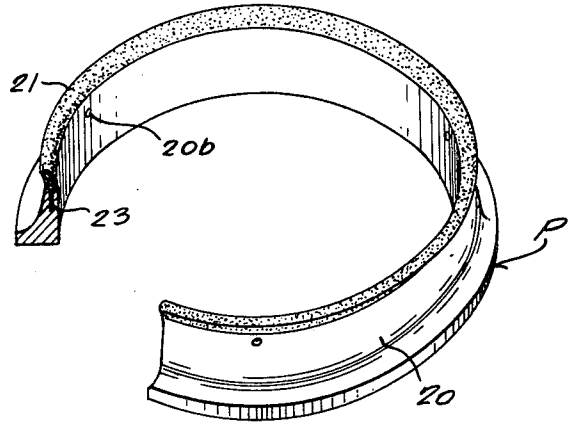
**ABSTRACT:** A composite metal and flexible material pattern for making a sand mold, and in which the flexible material is used in the back draft area to thereby permit the use of a single pattern which can be removed without damage to the sand mold. The single pattern is made so that when the flexible material portion of the pattern is worn or damaged, it can be readily removed from the rest of the pattern, namely the rigid metal portion, and replaced with a new flexible material portion.

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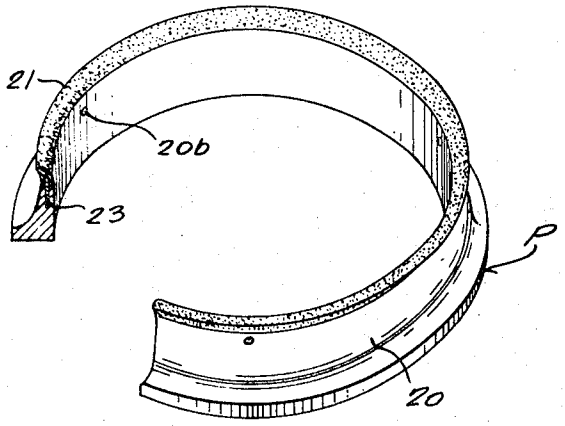


Fig. 1

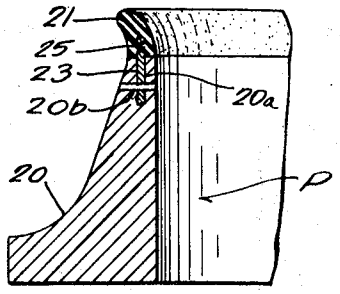


Fig. 2

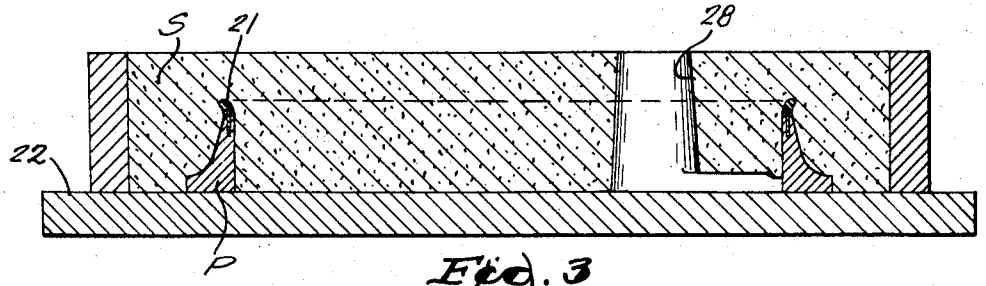


Fig. 3

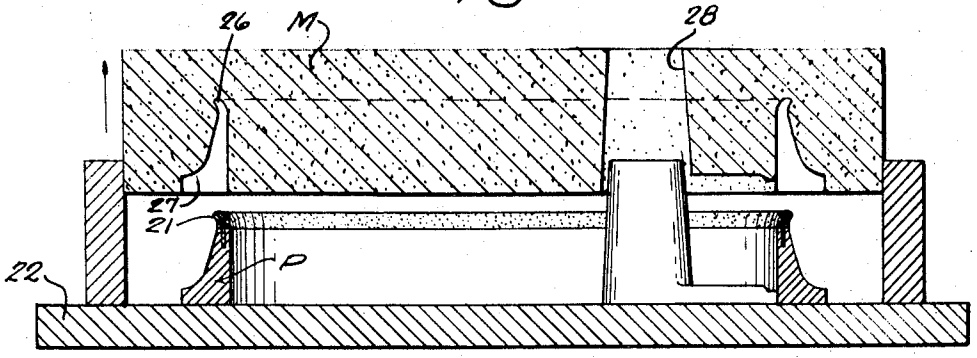


Fig. 4

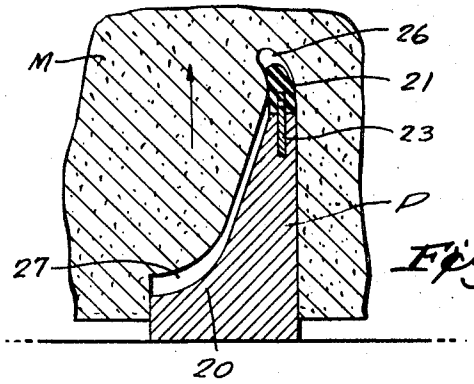


Fig. 5

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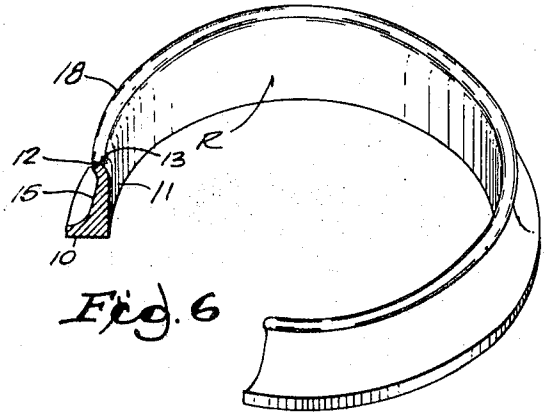


Fig. 6

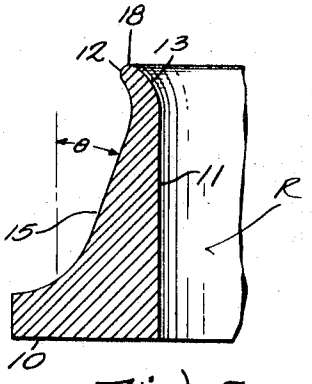


Fig. 7

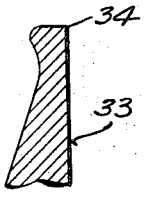


Fig. 10

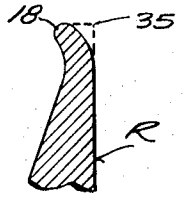


Fig. 11

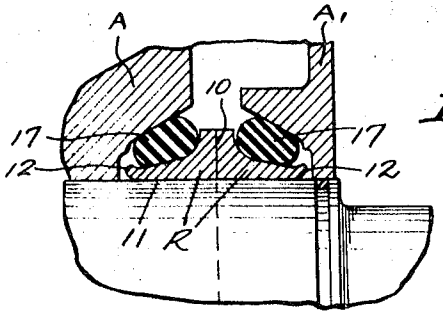


Fig. 12

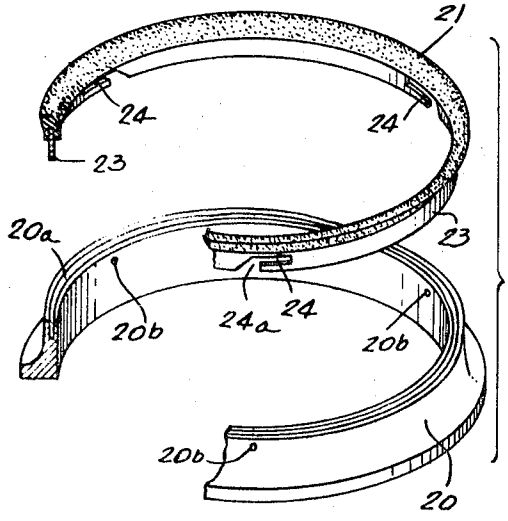


Fig. 8

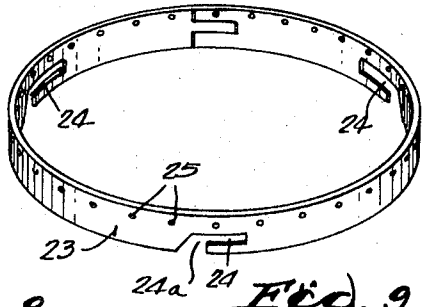


Fig. 9

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# PATTERN FOR MAKING MOLD WITH A BACK DRAFT

## BACKGROUND OF THE INVENTION

The present invention is in the nature of an improvement over the pattern shown in the copending U.S. Pat. application Ser. No. 744,484, filed Jul. 12, 1968, and entitled "One Piece Pattern and Method for Making Sand Mold with a Back Draft, and Product Made Therefrom," now issued as U.S Pat. No. 3,516,477 on Jun. 23, 1970.

The above mentioned application discloses a composite pattern for making a sand mold, which pattern is made of both a metal and a flexible material, the flexible material being bonded to the metal and the flexible material forming the back draft area of the mold. These patterns have proved to be highly successful.

## SUMMARY OF THE INVENTION

The present invention provides a composite metal and flexible material pattern for making a sand mold either by a cold or heated process, wherein the flexible material forms the back draft area of the mold, and in which the flexible material is detachably fixed to the metal portion of the pattern so that it can be readily replaced when worn or damaged in use. As the flexible material is relatively fragile and subject to wear and damage when repeatedly withdrawn from the completed mold, the present invention provides a pattern in which the flexible material portion can be readily removed and a new flexible material portion, which is also bonded to an insert collar, can be slipped into the more or less permanent and rigid, metal portion of the pattern, and securely locked in placed.

In this manner, only a small portion of the pattern need be replaced when the flexible material is worn.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a pattern embodying the present invention for a mold for making a seal ring, a portion being shown as broken away and in section for clarity;

FIG. 2 is a cross-sectional view through FIG. 1, but on an enlarged scale;

FIG. 3 is a cross-sectional view through a pattern as shown in FIG. 2 and as it is located in a sand mold;

FIG. 4 is a view similar to FIG. 3 but showing the cured sand mold being removed;

FIG. 5 is an enlarged view of a portion of the FIG. 3 arrangement, but with the mold as it is partially removed and with the pattern back draft portion deformed;

FIG. 6 is a perspective view, with a portion broken away, of a seal ring made in accordance with the present invention;

FIG. 7 is an enlarged, fragmentary, sectional view through a seal ring made in the mold shown in FIGS. 3, 4 and 5;

FIG. 8 is a perspective exploded view of a pattern made in accordance with the present invention;

FIG. 9 is a perspective view of the locking collar only of the pattern shown in FIG. 8;

FIG. 10 is a fragmentary, cross-sectional view on an enlarged scale of a portion of a conventional seal ring made in the conventional mold shown in FIG. 9;

FIG. 11 is a fragmentary, sectional view of a seal ring made in accordance with the present invention, similar to the FIG. 7 showing, but in addition showing in dotted line the conventional corner of the conventional seal ring of FIG. 10; and

FIG. 12 is a fragmentary, cross-sectional view through a shaft and its parts and showing a pair of seal rings in use and which have been made in accordance with the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

A seal ring R made from a mold which in turn was made by a pattern of the present invention, is shown in cross section in FIG. 7 and in perspective in FIG. 6. These extremely hard ferrous alloy rings are also shown in use in FIG. 12 and are slipped on a shaft in back-to-back relationship, that is with



their radial surfaces 10 abutting against one another. A pair of metal parts A and A1, such as for example a track roller and a seal cover, respectively, are also mounted on the shaft and must be sealed.

The rings are mounted on the shaft by their generally cylindrical and axially extending central opening, defined by their relatively long internal, cylindrical surface 11. The small end 12 (FIG. 7) of a ring has a rounded corner 13 extending from the cylindrical surface 11 and then curves radially away from the surface 11. The rounded internal corner 13 at the junction of the central opening of the ring, is important and will be referred to later. The ring R also has an external, annular inclined surface 15 which diverges in an axial direction away from the smaller end of the ring R. The angle $\theta$ of this inclination is about 15° from the longitudinal axis, as shown in FIG. 7. This inclined surface 15, is inclined radially outwardly in a direction away from the part P or P1 against which its O-ring will seal. It is on this inclined surface that a flexible O-ring seal 17 is mounted so that when assembled, the seal 17 is pushed against the metal part to thereby urge it into sealing position.

The metal seal ring R has a generally radially extending flange 18 which extends radially beyond a portion of the inclined surface 15 and functions to hold the flexible O-ring 17 on the ring R until final assembly of the parts and seals can be made. Thus the small rounded flange 18 forms an important part of the metal seal ring R, and the ring R must be made precisely and with a good finish so as to prevent injury to the flexible seal 17 and also to insure accurate and easy assembly. The surface 10 of each of the ring R is precisely finished to form a seal against the adjacent surface 10 of the adjacent ring R.

The ring R is preferably made of Stellite, and is made by a shell molding process and by a novel mold pattern now to be described.

A pattern P is made of a relatively larger, metal portion 20, for example of aluminum. A portion of the pattern 21 is also formed of flexible material, and silicone rubber has been found to be particularly desirable in this respect. Other flexible materials may be used, such as for example, teflon, which are resistant to the high heat necessary to cure the resin bonded sand S, if that type of process is used rather than a cold process with which the invention is also usable. The invention will be described as using silicone rubber as the flexible material.

When a mold is to be made by a heated process, the pattern P is placed on a heated surface 22, such as for example, a heated table used in core making machines of the type shown in the copending U.S. Pat. application Ser. No. 719,130, now U.S. Pat. No. 3,516,477 and assigned to Harris Metals, Inc., an assignee common with the present invention. If a description of the means and method for placing the sand S around the pattern P is deemed to be either necessary or desirable, reference may be had to that application. However, it is believed sufficient to say for purposes of this disclosure, that the pattern P and the resin bonded sand S which is poured over the pattern P, are heated to cure the sand. Preferably, a curing temperature at least about 400° F. is used with the present invention, which gives good production rates. Of course, lower temperatures can be used, but undesirably long curing times are then required.

The entire pattern P is of a shape such as above described for the finished seal ring R, and it will be noted that the silicone rubber forms only a relatively small portion of the whole pattern. The rubber is provided for that portion of the pattern which will form the back draft portion of the sand mold, namely, that portion which ultimately forms the rounded flange 18 of the ring R.

If the invention is used in a heated process, the silicone rubber not only can withstand the necessary curing heat, but it is of a sufficient durometer hardness to hold its proper shape during the sand filling operation of the mold box and pattern, and also during the heat curing of the mold. On the other hand, the silicone rubber has sufficient resiliency to be

withdrawn from the cured molds, as will appear, without damage to itself or to the mold. A durometer hardness of about 40 to 50 has been found to be very satisfactory.

As shown in FIGS. 8 and 9, the smaller flexible portion 21 of the pattern is removably fixed to the relatively permanent, metal portion 20 of the pattern by means of a locking collar 23 which is rolled from a flat strip of metal, such as steel. This collar has a series of locking recesses 24 circumferentially spaced therearound.

The collar also has a series of holes 25 into which the flexible material flows when it is molded to the collar in a negative mold (not shown). Thus, the flexible material, such as silicone rubber, is firmly bonded and locked to the collar 23.

The metal portion 20 has a groove 20*a* formed in its edge and a series of small pins 20*b* extending across the groove at circumferentially spaced locations which correspond to the locking recesses 24 of the collar. Thus, the collar is snugly received in the groove 20*a* so that the flexible material, which has been bonded to the collar, bears tightly against the metal portion 20 when the collar has been slipped into the groove 20*a*. More specifically, when it is desired to assemble the flexible portion 21 on the rigid portion 20 of the pattern, it is only necessary to place the collar in the groove 20*a* with the entry portion 24*a* of the locking recesses 24 over their respective pins 20*b* in the collar. A slight twisting of the collar relative to the portion 20, then causes the locking portion 24*b* of the recesses 24 to slide over their respective pins 20*b*, thus locking the flexible portion securely on the portion 20.

To remove the flexible portion, after it has become worn or otherwise damaged, it is only necessary to twist it in the reverse direction and lift the collar from the groove 20*a*.

As shown in FIG. 4, the pattern P is removed or the mold is lifted from the pattern. FIG. 5 shows this initial relative movement during which the silicone rubber portion 21 of the one piece pattern P must be withdrawn from the back draft area 26 of the mold. As shown in FIG. 5, the pattern has been partially removed, the silicone rubber deforming temporarily so as to pass from the back draft area 26 and into the larger, unrestricted area 27 of the mold.

Passages 28 have also been formed in the mold through which the metal is poured in casting the finished parts.

FIG. 10 shows the shape of the flange end of a seal ring 33 made on a conventional three piece mold. It will be noted that inside corner 34 is square.

FIG. 11 shows a comparison of the cross-sectional shapes of the ring R made with the present invention and the ring 33 made by conventional means. By making the inner corner of a round shape as in ring R, the silicone rubber can be withdrawn from the mold, as shown in FIG. 5. If the corner were square, the extra rubber material in the square corner 35 (FIG. 11) would not permit twisting of the flange-shaped, silicone rubber 21 in an axially direction (to the right as viewed in FIG. 4) as the rubber 21 is being pulled from the back draft area 26.

I claim:

1. A pattern for forming a sand mold having a back draft area, said pattern comprising, a larger metal portion of a shape to form that portion of the mold which has no back draft area, a smaller flexible portion removably attached to said metal portion and of a normal shape which complements the back draft area of said mold, said flexible portion being of sufficient resiliency to deform and pass out of said back draft area of said mold without damage to the latter as said mold and pattern are separated, and means for holding said flexible portion in removably fixed relationship with said metal portion, said means including a collar to which said flexible portion is bonded, and said collar is detachably secured to said metal portion.

2. The pattern described in claim 1 further characterized in that said metal portion has a groove formed therein for removably receiving said collar.

3. The pattern as claimed in claim 2 further characterized in that said metal portion has pin means extending into said groove, and said collar has locking recesses alignable and engageable with said pin means for detachable locking engagement of the collar with said metal portion.

4. The pattern of claim 1 further characterized in that said flexible portion is made of silicone rubber.

5. A pattern for forming a sand mold having a back draft area, said pattern comprising, a larger metal portion of a shape to form that portion of the mold which has no back draft area, said metal portion having a generally cylindrical and axially extending central opening and also having an external surface inclined to the longitudinal axis of said metal portion and forming a large end and a small end of said metal portion, a smaller flexible portion removably fixed to said metal portion and of a normal shape which complements the back draft area of said mold, said flexible portion forming a generally radially extending flange extending from said small end of said metal portion, said flexible portion also having a rounded internal corner joining one end of said central opening and the rest of said flange, said flexible portion being of sufficient resiliency to deform and pass out of said back draft area of said mold without damage to the latter as said mold and pattern are separated, and removable means for holding said flexible portion in removably fixed relationship with said metal portion.

6. The pattern set forth in claim 5 further characterized in that said means includes a collar to which said flexible portion is bonded, and said collar is detachably secured to said metal portion.

7. The pattern described in claim 6 further characterized in that said metal portion has a groove formed therein for removably receiving said collar.

8. The pattern as claimed in claim 7 further characterized in that said metal portion has pin means extending into said groove, and said collar has locking recesses alignable and engageable with said pin means for detachable locking engagement of the collar with said metal portion.

9. The pattern of claim 8 further characterized in that said flexible portion is made of silicone rubber.