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[73] Assignee **The Mead Corporation**
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[56]

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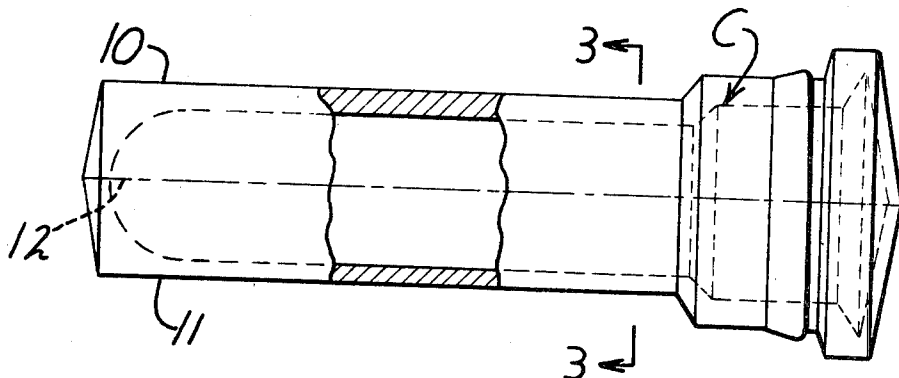
[54] **HOLLOW GREEN SAND CORES**
2 Claims, 7 Drawing Figs.

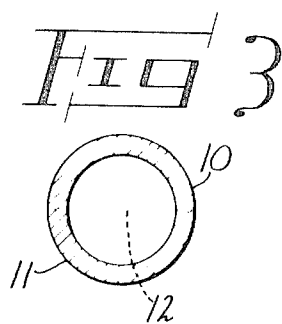
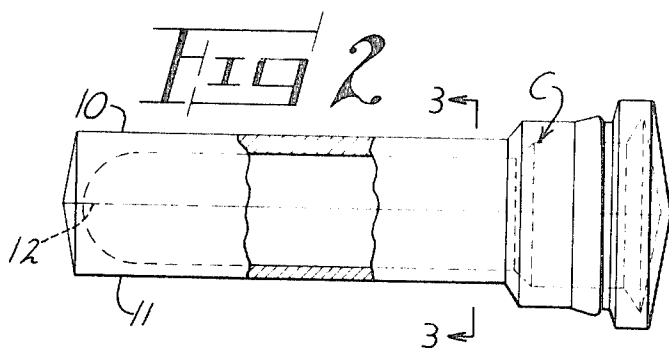
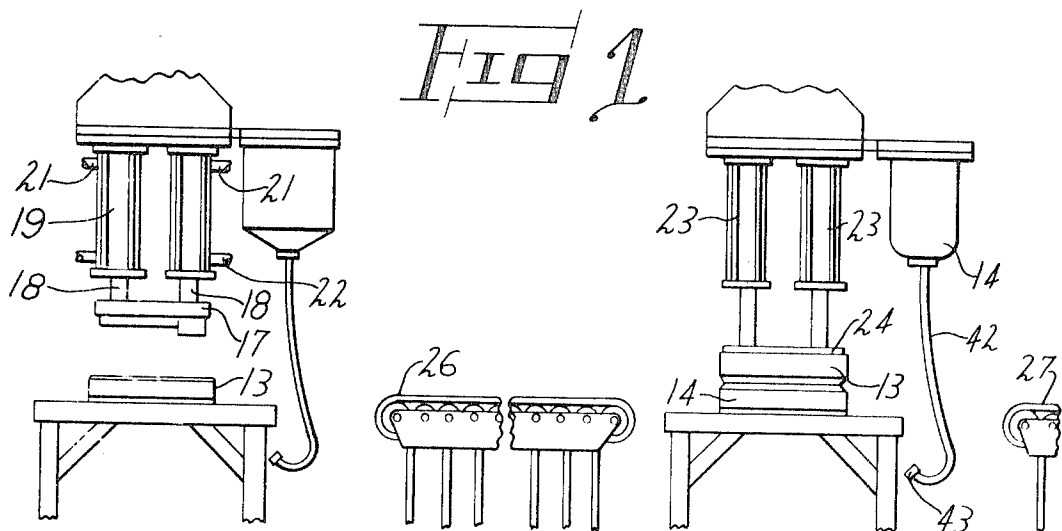
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ABSTRACT: A multipart green sand foundry core, preferably but not necessarily hollow, in which the parts are joined together solely by the adherence of sand in areas thereof which are brought together. Such cores are formed of green foundry sand without the use of any addition binder, gasing or the like.





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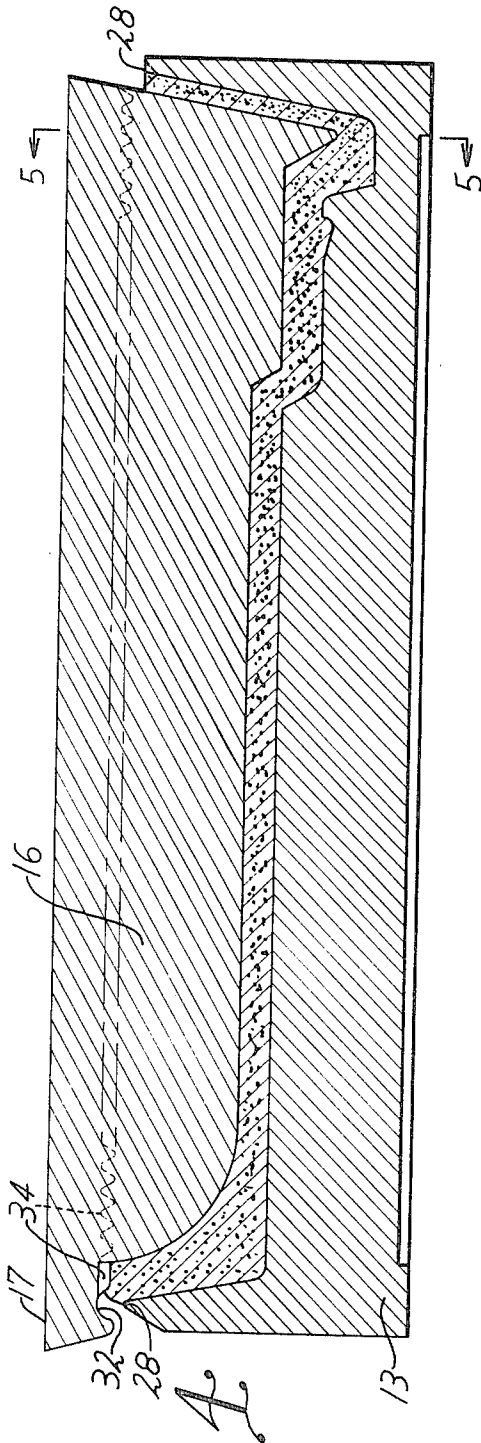


FIG 4

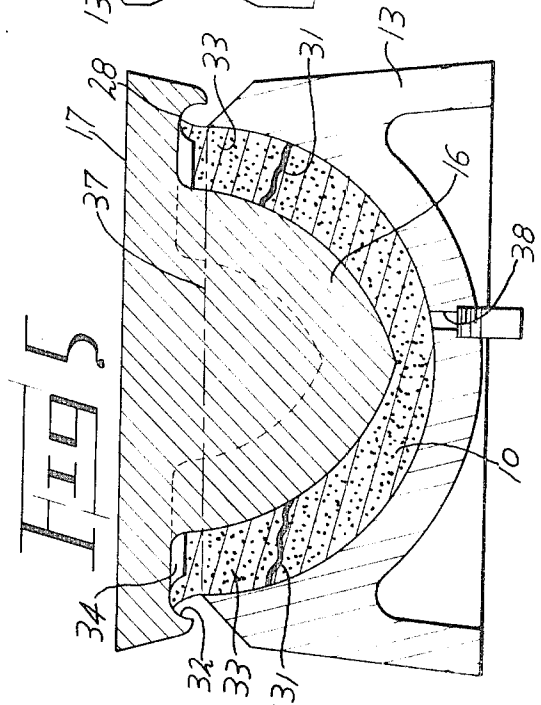
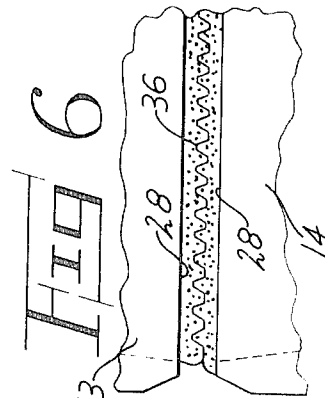
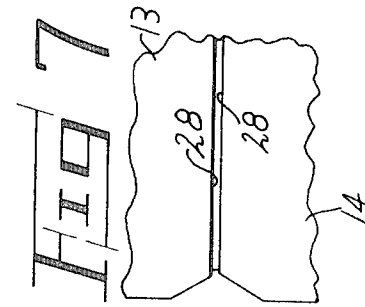


FIG 5

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HOLLOW GREEN SAND CORES

This application is a division of our pending application Ser. No. 713,037, filed Mar. 14, 1968, "Process of Making Green Sand Cores," now U.S. Pat. No. 3,496,988, dated Feb. 24, 1970.

Our invention relates to sand cores.

In this art it has long been desired to use foundry sand such as green sand in the formation of hollow cores. It has long been recognized that were this possible the use of binders, such as resins and the complicated machinery for forming thermosetting resin containing cores could be eliminated. However, insofar as we are aware no one heretofore has solved the problem because of the inherent difficulty of forming a hollow core and yet compacting or hardening the same to the degree required to serve and act as a core. In the past, attempts have been made to form such cores by internal compressing means such as expandable innertubelike members placed inside the core box which, when inflated, were supposed to press the sand against the box, thus to form the hollow core. Other attempts have been made to provide partial green sand cores, as for instance by providing one half of the core of baked sand and the other half of green sand. Further, attempts have been made to fabricate hollow green sand cores by blowing the sand around vented arbors.

An object of our invention relates to green sand cores of ordinary silica foundry sand, containing an average amount of clay and moisture, which sand, in the ordinary way after the core is used, may be reconditioned for subsequent use.

More specifically, an object of our invention is to provide a hollow green sand core in which the core is formed in halves, the halves being compacted to the necessary or required degree throughout the major body portions thereof, while the peripheral portions which are to be mated with a like half are left relatively uncompacted, and then completing the core by bringing the relatively uncompacted peripheral areas together and subjecting the parts thus brought together to pressure which finished the compaction in the uncompacted areas and at the same time bonds these areas together, thereby bonding the halves together to form the complete, usable core.

Another object of our invention is to provide a core in which the peripheral, relatively uncompacted areas thereof are increased as by making the same serrated, whereby when the parts are mated and the parts subsequently pressed together, a more efficient bonding and more efficient compaction is obtained in the relatively uncompacted areas.

Another object of our invention is to provide a sand core in which the parts, preferably halves, are formed with the peripheral portions to be mated extending generally above the transverse center line of the core body, whereby when the areas are mated and pressed together the excess volume of sand in the peripheral areas affords opportunity for ample bonding and compaction by a simply pressing of the halves together while in their core boxes.

A further object is to provide a green sand core formed of parts made as heretofore indicated and, to provide a core half or body part possessing the characteristics of being fully compacted throughout most of its body area while remaining relatively uncompacted in its peripheral areas, capable of being mated with a like part to form the complete core.

Apparatus which is suitable for making our improved core is illustrated in the accompanying drawings forming a part of this application in which:

FIG. 1 is a wholly diagrammatic view illustrating apparatus which may be used for forming the core halves and for assembling the complete core body;

FIG. 2 is a view of a completed core;

FIG. 3 is a detail sectional view taken generally along line 3-3 of FIG. 2;

FIG. 4 is a longitudinal sectional view through a core box which has the pattern in place therein showing the sand in the core box, substantially compressed, in order to form the core half;

FIG. 5 is a detail sectional view taken generally along line 5-5 of FIG. 4;

FIG. 6 is a fragmental side elevational view of a portion of two of the core boxes with the halves of the core therein just having been mated and ready to be finally pressed together; and,

FIG. 7 is a view similar to FIG. 6 and showing the core boxes pressed substantially together, resulting in bonding of the core halves.

Referring now to the drawings for a better understanding of our invention it will be understood that we propose a hollow core indicated generally by the letter C in FIG. 2 which is formed of two halves 10 and 11, joined together as will be explained, along the transverse part line 12.

In forming the halves we use core boxes 13 and 14 and mandrels 16 which may be mounted on baseplates 17. In FIG. 1 we show in wholly diagrammatic manner one of the mandrels 16 on its baseplate 17 mounted on the piston rods 18 of a pair of fluid pressure cylinders 19. It will be understood that fluid under pressure from a source not shown may be admitted to the upper connections 21 of the cylinders whereby the plate 17 and the mandrel 16 move downwardly into the core box 13. Similarly, the parts may be raised to the position shown in the lefthand side of FIG. 1 by admitting pressure to the connections 22 while exhausting it from the connections 21.

It will be understood, as will later appear, that the other half of the core, for instance the half 11, is to be formed in the core box 14 by means of apparatus like that illustrated at the lefthand side of FIG. 1 and that subsequently the two core parts still in their boxes 13 and 14, are to be mated and finally pressed together as illustrated in the right-hand portion of FIG. 1. Thus, we show fluid pressure cylinders 23 having a presser plate 24 disposed to press down upon the inverted core box 13 and to press it, with its core half therein, against the core half in the box 14. Conveyors 26 serve to deliver the core box 13 to the assembly station, whereas a conveyor 27 serves to deliver the core boxes 14 to the assembly station, it being understood that the core box 14 is filled, similarly to the one already described in connection with 13, at a station to the right of the conveyor 27, not shown.

Referring now to FIGS. 4 to 7 inclusive the first step in forming one half of our improved core is to pile into the box 13 or 14, as the case may be, a greater quantity of sand than will be required to form the core half. That is, the box is filled above the top 28 thereof. With this accomplished the next step is to bring the mandrel, forcefully by means of the cylinders 19, down into the sand, whereupon the parts assume the position shown in FIG. 5 thus to shape and form the core half 10. In the position of the parts shown in FIGS. 4 and 5 it will be understood that the sand in the major body portion of the core half is fully compacted, substantially all the way around and approximately to the lines indicated at 31. In the areas 33 above the lines 31 the sand is relatively uncompacted inasmuch as the parts are so disposed and the stroke of the piston rods 18 of the cylinders 19 and the applied pressure are such that the peripheral edges of the plate 17, which are undercut as indicated at 32, never contact the upper surfaces 28 of the core box 13 or 14, as the case may be. Thus, any excess sand originally placed in the core box spills out over the edges or periphery of the core box during the downward movement of the mandrel 16, due to the clearance at 32. It will be noted that this overhanging portion of the plate 17 is provided along the sides and at one end of the core box. Therefore, throughout the major body portions of the core halves the sand is fully compacted and in the sections indicated generally by the numerals 33, that is, along the periphery of the core, the sand is relatively uncompacted.

In order to increase the area of contact along the peripheral edges of the core halves we may provide the periphery of the plate 17 with teeth or serrations indicated by the numeral 34. It will be noted that the serrations or teeth 34, both at the sides and along the end where they are placed, do not extend outwardly enough to overlie the top 28 of the core box 13 or 14.

This affords ample clearance for the excess sand to be forced out of the core box during the downward movement of the mandrel 16. However, the result of such teeth is to leave on each core half projecting, serrated, toothlike sand configurations indicated at 36.

It will be understood that the mandrels for making the halves are so constructed that when the core boxes containing the halves are inverted as shown in the right-hand portion of FIG. 1, the sand teeth match as shown in FIG. 6. It will further be noted that the teeth on the halves of the core lie above the geometrical center line indicated by the line 37. Also, when forming symmetrical cores the teeth lie above the line of joinder of the parts indicated by the line 12. Therefore, when the halves are mated for final compaction as indicated in FIG. 6 the amount of compaction left to be accomplished is the space represented between the peripheral edges 28 of the core boxes. Thus, starting with the mated halves as shown in FIG. 6 the core boxes 13 and 14 are simply pressed together until their edges 28 substantially contact as shown in FIG. 7, thus completing the operation and effectively joining the core halves to form the complete core C.

In carrying out our invention and when forming cores of green sand we use silica sand containing about ten to fifteen per cent clay and about three to five per cent of moisture, both by weight. Such sand has a green compressive strength of from about 18 to about 25. The mandrel 16, being pressed into the mold box which has been substantially filled with such sand produces a hardness of about 85 to 95 in the body areas of the core halves between the lines 31 as shown in FIG. 5. In the contacting areas 33 we estimate that the hardness may be on the order of 50 or less. Thus, when the halves are mated as shown in FIG. 6 and compacted fully as shown in FIG. 7 the volume of sand in the areas 33 is compacted, we believe, to somewhere in the range of 80 to 90 on the standard mold hardness tester. As a matter of fact, cross sections through the peripheral, joined areas show no distinct lines of joinder, showing complete integration of the core bodies.

In the drawings we show a core box half 13 for making one-half of a core which is to be used to pour a fitting for cast iron pipe. However, it will be readily apparent that the configuration of the core box 13 may be varied and that the configuration of the mandrel 16 may likewise be varied to form any desired shape. However, and as stated, in order to bond the halves together to a degree to make the entire core satisfactory for pouring purposes the upper peripheral edges must be compacted to a less degree than the main body of the halves so that when mated and further compacted, bonding and adherence take place around the periphery.

In order to remove the completed core from the mold halves each of the boxes 13 and 14 may be provided with air passages 38. At the right-hand station shown in FIG. 1 we may provide an air pressure tank 41 with a flexible hose 42 and a nozzle 43. After final compaction and formation of the core C, air may be supplied to either of the passages, or to both, thus to loosen the completed core for removal. In carrying out this operation it will be understood that the pressure plate 24 is raised and that air under fairly low pressure is admitted through the openings 38, this having the effect of loosening the halves, permitting them to strip from the core boxes 13 and 14, whereby the core may be handled in the ordinary foundry process. Also, and as is customary, we prefer to dust or spray the inner surfaces of the core boxes 13 and 14 prior to packing the sand therein.

In view of the foregoing it will be apparent that we have devised an improved hollow foundry core of uniform wall thickness. To those skilled in the foundry art the importance

of providing a hollow core will be readily apparent. Amount other advantages it should be pointed out that the provision of the hollow core permits occluded gases in the iron or other metal being poured to vent themselves into the inside of the core during the pouring operation, thus resulting in sounder castings. It will be further understood that the core is supported on a print in the mold to be poured. Further, the thickness of the walls of the core can be varied to suit the particular circumstance encountered in the production of the finished parts to be cast and our invention lends itself to the formation of cores of varied shaped and complexities.

In actual practice we have found that our improved core is entirely satisfactory. Furthermore, we have found that it is possible to automate the formation of these cores into a completely automated casting machine which includes the core forming section, the core setter section, the pouring section, and the shakeout section. The advantage of hollow versus solid cores in the shakeout operation is well known. While it is extremely difficult to obtain precise measurements of the degree of compaction of the sand in the areas 33, particularly in the serrations or teeth 36, nevertheless we believe, from practical observations and tests that on the surface of the teeth the compaction is about on the order of 50 or less, when measured with a standard hardness tester and when using green sand. Of course, as the measurements are taken from the very top of the half of the core downwardly, the hardness increases until finally, somewhere downwardly of the lines 31 the body is almost fully compacted up to about 85 to 95 hardness. In any event, we have found that our improved green sand cores are strong enough to be handled in the ordinary course of using them in the foundry arts, are fully capable of being poured upon to form sound castings and still are frangible enough to be easily broken up by shaking to remove them from the finished parts.

While we have laid particular stress herein on forming cores of green sand it will be understood that our invention has utility in producing cores made of sand containing chemicals which react to heat, gases or the like to cure the cores. In such cases the steps herein set forth for forming the core parts are carried out using the desired materials. After assembling the halves and while they are still in their boxes the core may be hardened by gasing, heating, etc. Thus, our invention has utility in making hollow cores, whether or not green sand is used and this is true because once partially packed and then brought together, the arts of our improved core may be hardened or cured by means other than compaction alone. However, as will be appreciated the formation of usable, hollow cores of green sand by our process has unlimited uses in the art.

While we have shown our invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What we claim is:

1. A hollow core formed of green sand comprising a pair of centrally hollow parts integrally joined in peripheral areas thereof solely by the adherence of sand in those areas, said peripheral areas in cross section being devoid of any distinct line of joinder.

2. A core as defined in claim 1 in which the degree of compaction of the sand of the core in said peripheral areas of the parts is different than that existing throughout the remainder of the core.