Nov. 28, 1961 R. L. OLSON 3,010,165

WEAR RESISTANCE AND CUSHIONING MEANS FOR FOUNDRY FLASKS AND PATTERNS

Filed Dec. 9. 1958

Fig. 1

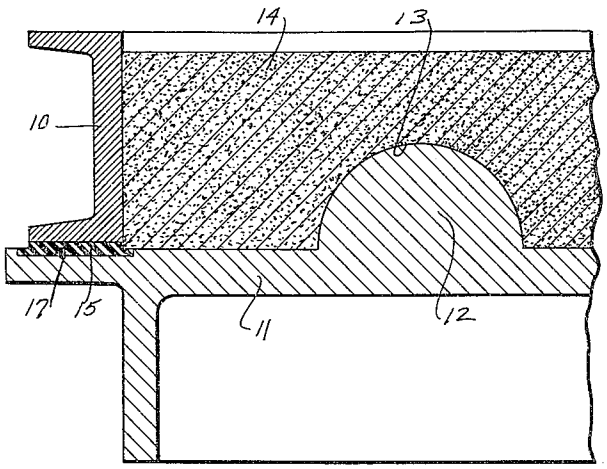


Fig. 5

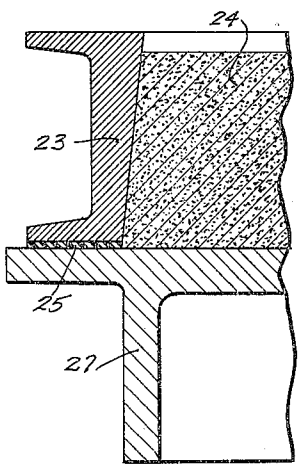


Fig. 2

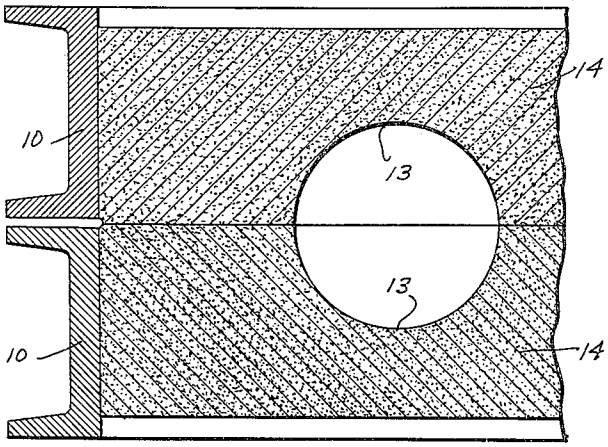


Fig. 3

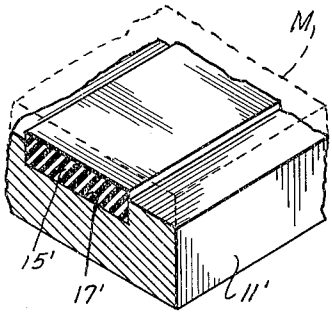
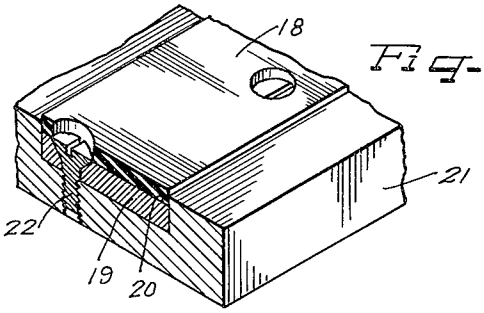


Fig. 4



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United States Patent Office 3,010,165 Patented Nov. 28, 1961

3,010,165

WEAR RESISTANCE AND CUSHIONING MEANS FOR FOUNDRY FLASKS AND PATTERNS

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Filed Dec. 9, 1958, Ser. No. 779,085
10 Claims (Cl. 22—96)

The present invention relates to improvements in means to prevent wear of the bearing surfaces between foundry flasks and patterns which are subjected to jolting in order to compact the molding sand, and also to cushion such bearing surfaces and thus reduce the prior excessive noise resulting from jolting of the assembly.

In preparation for sand mold casting, a cope or drag pattern plate, now usually made of aluminum, is bolted to the jolting mechanism of a jolt machine. A four-sided flask open at the top and bottom is properly aligned with and placed upon the pattern plate. Then the flask is filled to overflowing with foundry molding sand. Upon actuation of the jolting machine, the sand-filled flask and pattern assembly is lifted and dropped through about a twelve inch cycle at about 100 strokes per minute, which results in the sand being firmly packed around the contours and projections of the pattern.

During the jolting action, stray sand migrates into the bearing or parting face joints between the flask and the pattern plate. Due to the weight of the flask and the high impact of the jolt action, these stray grains of sand are crushed or forced to penetrate the surfaces of the bearing joint. This results in a highly abrasive, wearing action in the bearing surfaces. As the wear progresses, the relatively softer bearing surface of the pattern plate is ground and abraded away until the harder bearing surface of the flask after a series of moldings projects below the normal parting face of the pattern. In consequence eventually the sand mold parting face is located in an inset plane relative to the parting face of the flask. When the two mold halves are then assembled with this condition existing in one or both of them, the flask partings may be in tight abutment, but the mold partings are separated in direct proportion to the amount of wear in the cope and drag pattern plates. When the casting is poured it is out of size and has excessive flash or fin which must be removed. Eventually castings may have to be scrapped due to being excessively oversize.

Heretofore foundries have attempted to correct this condition of wear between the bearing surfaces of the flasks and pattern plates by inserting steel strips in the bearing surface areas of the pattern plates. Nevertheless, on high production jobs it is necessary to replace these steel insert strips at frequent intervals. In some foundries the bearing surface wear on the flasks is alleviated by the installation of cast steel frames. All of these expedients are costly and time consuming. Production schedules are frequently interrupted by down time losses while the pattern equipment is being repaired. Furthermore, a heavy burden is placed on supervisory and inspection personnel in maintenance of quality control in order to avoid excessive scrap losses.

An additional serious problem that has heretofore confronted foundries using jolt machines or combination jolt and squeeze machines has been the excessive noise resulting from the jarring and clatter incident to jolting of the flask and pattern assemblies. In spite of the lowering of worker efficiency and the well known health hazards due to excessive noise, no one has apparently heretofore suggested any solution for this problem.

It is accordingly an important object of the present invention to provide improved means for preventing wear

between the bearing surfaces of sand molding flasks and pattern plates used in jolting machines.

Another object of the invention is to provide novel cushioning means for the bearing surfaces of pattern plates engageable by sand mold flasks to prevent wear of the bearing surfaces during jolt-compacting of the molding sand in the flask and pattern assemblies.

A further object of the invention is to provide improved wear preventing and cushioning means to be carried by the bearing surfaces of sand mold flasks engageable against pattern plates in jolt machines.

Still another object of the invention is to provide combination wear preventing and sound damping means for sand mold flasks and patterns subject to jolting compaction of the molding sand.

Yet another object of the invention is to provide an improved method of preventing wear and damping noise in jolting sand mold flask and pattern assemblies.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a fragmentary vertical sectional, more or less schematic view of a sand mold flask and pattern assembly embodying features of the invention;

FIGURE 2 is a fragmentary more of less schematic vertical sectional view through an assembly of sand mold flasks showing the improved results attained in close lapping, bearing engagement of the sand mold parting faces as a result of employing the features of the present invention;

FIGURE 3 is a fragmentary isometric view showing a slightly modified structure of the wear preventing and cushioning structure;

FIGURE 4 is a fragmentary isometric sectional detail view showing a modified construction of the combination wear preventing and cushioning means; and

FIGURE 5 is a fragmentary vertical sectional more or less schematic view showing a modification wherein the wear preventing and cushioning means is carried by the flask rather than by the pattern plate.

According to the present invention, wear between the bearing surfaces of a sand molding flask and pattern assembly is substantially prevented and the jarring, clattering noise incident to jolting compaction of molding sand in the assembly is substantially alleviated by affixing with a high degree of permanence, as by curing directly on the supporting or carrying surface in the assembly a highly abrasion resistant elastomeric cushion, assembling the flask and pattern components with the cushion interposed between the bearing surfaces and actually providing one of such bearing surfaces, filling the flask with molding sand, and then joltingly compacting the sand in the flask and onto the pattern, as in a jolting machine wherein the assembly is rapidly jolted, the cushioning means substantially preventing abrasion to the opposing metallic bearing surface, and also damping noise producing vibrations and absorbing impacts between the components which would otherwise create undesirable noise.

Illustrative of a practical application of the present invention a sand mold flask **10** (FIG. 1) is assembled with a pattern plate **11** which may be either the cope or drag and has thereon approximately half a pattern **12** to form a corresponding metal molding cavity **13** in a body of compacted foundry molding sand **14** retained in the flask **10**. In this instance, the flask **10** is of the type known as a tight flask in that it remains in sand retaining position until molding or casting of the metal piece for which the mold is intended has been completed.

In providing the molding sand body **14**, after assembly of the flask **10** upon the pattern plate **11** has been effected, the flask **10** is filled with molding sand which is then compacted tightly onto the pattern surfaces of the pattern plate **11** and against the confining wall of the flask **10**. Such compacting may be effected either in a jolt machine wherein the pattern plate **10** is secured, or in a squeeze molding apparatus, or in a combination jolt and squeeze molding machine. In a jolt machine, the assembly is rapidly jolted to effect compacting of the sand. In a squeeze molding apparatus, high pressures are applied on top of the body of loose sand to compact the same. In a combination machine, these operations, namely jolting and squeezing are combined. In either case, substantial compaction of the sand body **14** results as evidenced by insetting of the top surface of the sand body from an overflowing or at least level loose sand condition.

During compaction of the sand body **14** whether by jolting, squeezing, or a combination of jolting and squeezing some sand strays or works in between the opposed bearing surface areas of the flask **10** and the pattern plate **11** resulting in substantial wear due to abrasive action of the crushed sand. Where any sizable production runs are involved, the repeated abrasion and wearing of opposed metal bearing surfaces of the flask and pattern plate soon results in a depressed contact or bearing surface on the pattern plate which is customarily made from a material such as aluminum and thus substantially softer than the material of the flask which may be cast iron or cast steel. Even where steel facing strips are mounted on the pattern plate to provide the bearing surfaces thereof, for high production units, fairly frequent replacement of such strips has been necessary.

By providing a wear resistant and cushioning bearing surface structure **15** (FIG. 1) on the pattern plate **11** to underlie all of the opposed bearing surface area of the flask **10** not only is abrasion wear substantially eliminated, but in jolting the molding assembly noise is substantially eliminated. In order to have the wear resisting and cushioning structure of sufficient mass to be effective with presently available materials, it is desirable to provide the same of substantial thickness and mount the same within a recess **17** formed in the bearing surface area of the pattern plate **11** and projecting preferably slightly above the normal face plane of the pattern plate. A projection of about .010 inch has been found practical. If preferred, the recess or groove **17** and the material of the cushion **15** may be slightly wider than the maximum width of the opposing flask bearing surface. This is especially desirable where the cushion **15** is installed in a worn pattern plate bearing surface.

In the anti-abrasion and cushion structure **15**, an elastomeric material highly resistant to abrasion and impact is utilized. Such material must also be resistant to the parting or cleaning agents such as or including kerosene used on the pattern plate. Satisfactory material comprises at least certain of the synthetic rubber-type materials such as Buna-N and polyurethane.

In view of the severe pressures and impacts to which the wear resistant and cushioning structure **15** is subjected in use, it is essential that it be bonded permanently in place to resist tenacious forces tending to separate it from the surfaces to which bonded. This can be effectively done by curing or vulcanizing the cushioning material directly in place. This is schematically illustrated in FIGURE 3 wherein the cavity **17'** is closed by a master molding plate M which may have a shallow matching groove in its parting face, or at least a groove which will provide a sufficient projection of the finished cushion **15'** above the normal face plane of the pattern plate **11'**. The surfaces within the groove **17'** are treated as by means of a suitable bonding agent to assure thorough bonding of the cushion material thereto while the opposing molding surface areas of the master plate M are treated with a separating agent. A suitable quantity of raw material compound including the synthetic rubber, a plasticizer and a vulcanizing agent is placed within the chamber defined by the recess **17'** and the master plate M and the assembly then placed in an oven wherein the elastomeric material compound is subjected to sufficient heat for a suitable length of time to effect curing or vulcanization. After curing has been completed, the master plate M is removed and the pattern plate is ready to be placed in use. In the completed, cured cushion a reasonably dense, uniform structure of a durometer rating affording fairly stiff resilience and a smooth, flat, non-porous bearing surface has been found well suited for the purpose.

By having the slight projection of the abrasion resistant cushion **15** above the parting face of the pattern plate **11**, a corresponding slight offsetting of the parting face of the sand body **14** is effected relative to the bearing surface area of the flask **10**. Hence, referring to FIGURE 2, when the cope and drag sand mold bodies **14** of a matching set are assembled in complementary relation the parting faces of the sand bodies **14** will be flush and thus reasonably preclude flash or fins on the article cast within the molding cavity of the matching molds.

If preferred, instead of molding the abrasion resisting cushion directly onto the pattern plate, the expedient illustrated in FIGURE 4 may be employed wherein an elastomeric cushion **18** is permanently bonded to a metal carrying strip **19** which is mounted within a conforming recess **20** in a pattern plate **21**. The depth of the recess or groove **20** is such that a substantial portion of the body of the elastomeric cushion **18** is below the parting face of the pattern plate **21** with only a small portion projecting thereabove. To hold the cushion strip **18** and its base plate or strip **19** in place retaining screws **22** may be used, the heads of which are countersunk into the base plate **19** and the shanks of which are threadedly engaged in suitable threaded openings in the pattern plate **21**. This provides a convenient means for equipping pattern plates with the wear resisting and sound damping cushion without requiring the entire pattern plate in each instance to be placed in a curing oven. With the insert strip structure the cushion material **18** can be vulcanize bonded onto the base strip **19** in a plant devoted to this process and then distributed to pattern makers or foundry shops where the cushioning strips can be installed.

Where flasks of the removable type known as pop-off or snap or slip flasks are employed, of which an example of a slip flask **23** is shown in FIGURE 5, having suitably oblique molding faces so as to be readily removable from a compacted sand mold body **24** to be replaced by a retaining band during casting, the flask bearing surface may be provided with an elastomeric cushion **25** to oppose the parting face of a pattern plate **27**. For this purpose the elastomeric cushion **25** is permanently bonded as by vulcanizing it directly onto the bearing surface of the flask **23**. In such case, of course, a master plate is provided in which the face opposing the bearing surface of the flask is cavitated to afford a thin flat cushion body on the bearing surface of the flask.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a process of sand molding in an assembly of flask and pattern plate members preparatory to casting metal articles and during which molding the sand is firmly compacted while opposed bearing surfaces of the flask member and the plate member remain in close opposition but are liable to migration of sand particles into and between the bearing surfaces from the body of sand confined within the flask upon the plate, bonding directly onto the bearing surface area of one of said members a wear resisting resilient bearing cushion, assembling the flask and pattern members with said cushion engaging the bearing surface of the remaining member and the cushion providing the entire supportive connection between the members and

avoiding any direct contact of said bearing surface areas, filling the flask member with molding sand, compacting the sand within the flask member and onto the pattern member, and during the compacting cushioning any sand grains that may be on said bearing cushion whereby substantially to inhibit the abrasive and wearing action of the sand grains on the bearing surface area of the other of said members.

2. In a process of sand molding in an assembly of flask and pattern plate members preparatory to casting metal articles and during which molding the sand is firmly compacted while opposed bearing surface areas of the flask member and the plate member remain in close opposition but are liable to migration of sand particles into and between the bearing surfaces from the body of sand confined within the flask upon the plate, forming a groove in the bearing surface area of the pattern plate substantially matching the width of the bearing surface area of the flask, bonding directly and in a manner to be highly resistive to separation to supporting surface within said groove a highly abrasion and wear resisting resilient non-metallic cushion with the top of the cushion no lower than the bearing surface area of the pattern plate member, assembling the flask and pattern members in sand molding relation with said bearing cushion in firm completely supporting engagement with the bearing surface of the flask member and entirely avoiding any direct contact of the flask and pattern members except through said cushion, filling the flask member with molding sand, compacting the sand within the flask member and onto the pattern member, and during the compacting cushioning any sand grains that may be on said cushion whereby substantially to inhibit the abrasive and wearing action of the sand grains on the bearing surface of the flask member.

3. The process of claim 2 further characterized by: forming the bearing cushion to project slightly and on the order of .010 inch above the bearing area of the pattern plate member, and thereby during the sand molding maintaining the bearing area of the flask member correspondingly offset from the bearing area of the pattern member and producing a corresponding slight offset of the sand body bearing area from the parting face of the flask to assure positive lapping engagement of the parting face of the sand body with a mating sand body for substantially finless casting of a metal article therebetween.

4. In a process of sand molding in an assembly of flask and pattern plate members preparatory to casting metal articles and during which molding the sand is firmly compacted while opposed bearing surface areas of the flask member and the plate member remain in close opposition but are liable to migration of sand particles into and between the bearing surfaces from the body of sand confined within the flask upon the plate, treating the bearing surface area of one of said members with a bonding agent, assembling with said bearing surface area a quantity of a moldable elastomeric material in uncured state, enclosing the material and the bearing surface area with a molding plate, curing the enclosed material and thereby bonding it to said bearing area and forming it into a wear and abrasion resisting firmly resilient bearing cushion, removing the molding plate, assembling the flask and pattern members in sand molding relation with said bearing cushion of said one member engaging and providing the entire supportive contact with the bearing surface of the remaining member, filling the flask member with molding sand, compacting the sand within the flask member and onto the pattern member, and during the compacting cushioning any sand grains that may be between the bearing cushion and the opposing bearing surface of said remaining member whereby substantially to inhibit the abrasive and wearing action of the sand grains on the bearing surfaces so as to maintain such bearing surfaces substantially wear free throughout numerous compactings of sand fills of the flask and pattern members in assembly.

5. The process of claim 4 further characterized in that said one member comprises the flask, and the bearing cushion is formed as a thin substantially uniform layer over substantially the full bearing area surface of the flask.

6. In a sand molding assembly including flask and pattern plate members, said members having opposing bearing surface areas liable to migration of sand particles into and between the bearing surface joint from a body of sand confined within the flask upon the plate and solidly compacted, one of said bearing surfaces comprising an abrasion and wear resisting firmly resilient non-metallic bearing cushion bonded onto supporting surface of said one member and abutting the surface area of the other member in face-to-face completely supporting relation whereby said cushion substantially inhibits the abrasive and wearing action of sand grains between the cushion and the abutting surface area of said other member.

7. In a sand molding assembly including flask and pattern plate members, said members having opposing bearing surface areas liable to migration of sand particles into and between the bearing surface joint from a body of sand confined within the flask upon the plate and solidly compacted, the bearing surface area of the pattern plate having therein a groove of substantial depth and substantially matching the bearing surface area of the flask member, and a rubber-type elastomeric stiffly resilient wear and abrasion resisting cushion bonded directly into said groove and filling the same and having a bearing surface thereon matching the bearing surface of the flask and engaging the bearing surface of the flask in face-to-face supporting relation and being disposed in a bearing surface plane no less than the plane of the pattern plate adjacent to the groove, said cushion providing the entire contacting area of the pattern plate with respect to the flask so that the cushion inhibits the abrasive and wearing action of sand grains between it and the bearing surface of the flask during compacting of molding sand in the flask and onto the pattern plate.

8. In a sand molding assembly including flask and pattern plate members, said members having opposing bearing surface areas liable to migration of sand particles into and between the bearing surface joint from a body of sand confined within the flask upon the plate and solidly compacted, and the bearing surface area of the flask having thereon a thin flat layer of a wear and abrasion resisting firmly resilient bearing cushion bonded permanently thereto and affording the entire supportive engagement between the members so that during compacting of the sand any grains of sand present between the cushion and the opposing bearing surface of the pattern plate will be cushioned by the cushion and inhibited from abrasive and wearing action on the bearing surface of the pattern plate.

9. In a sand molding assembly including flask and pattern plate members, said members having opposing bearing surface areas liable to migration of sand particles into and between the bearing surface joint from a body of sand confined within the flask upon the plate and solidly compacted, the bearing surface area of the pattern plate having therein a groove substantially matching the bearing surface area of the flask in width and of substantial depth, a metal strip substantially filling said groove as to width but of a thickness less than the depth of the groove, and a wear and abrasion resisting firmly resilient bearing cushion comprising an elastomeric layer bonded directly to the strip and the cushion affording the entire supportive engagement for the bearing surface area of the flask, whereby any sand grains present between the cushion and the opposing bearing surface area of the flask will be substantially inhibited from abrasive and wearing action on said bearing surface of the flask upon compacting of the sand in the assembly.

10. In a sand mold construction wherein a pattern plate is assembled with a flask and sand is filled into the flask

onto the pattern plate and then subjected to compacting as by jogging the plate and flask assembly, an abrasion and wear resisting firmly resilient bearing cushion structure comprising a metal strip receivable in a groove in the bearing area of the pattern plate opposing the bearing area of the flask, means for securing the strip into the groove, and a thin flat layer of an elastomeric material permanently bonded to the bearing face of said strip and the layer of elastomeric material affording the entire supportive engagement with the bearing area of the flask and thus being in wear protective and cushioning relation with the bearing area of the flask so that sand grains between the elastomeric material and the bearing surface of the flask will be substantially inhibited from abrasive and wearing action on the bearing area of the flask during jogging.

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