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2,807,846

INGOT MOLD MATS

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2 Sheets-Sheet 1

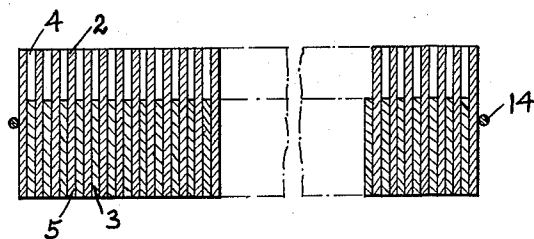


Fig. 1.

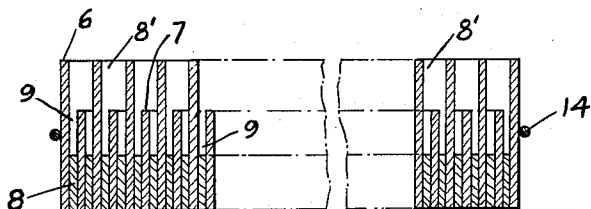


Fig. 2.

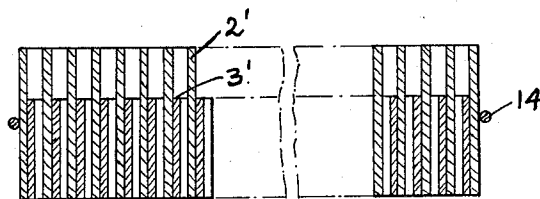


Fig. 3.

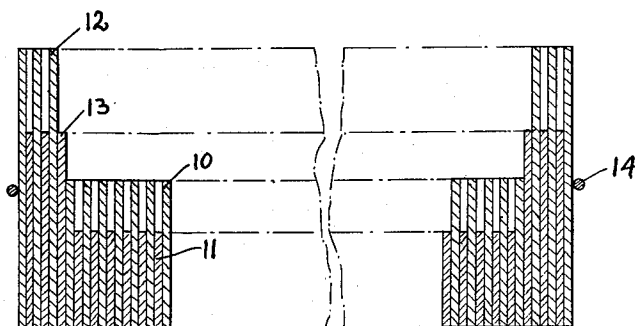


Fig. 4.

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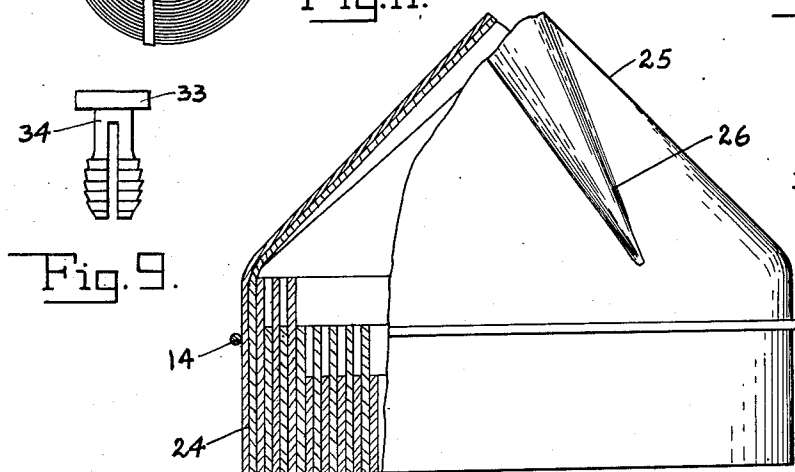
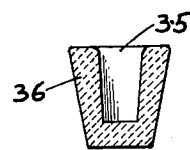
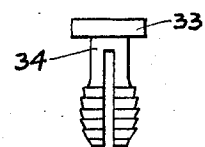
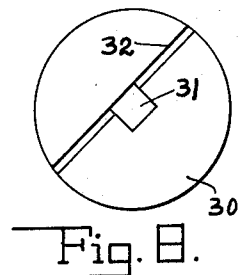
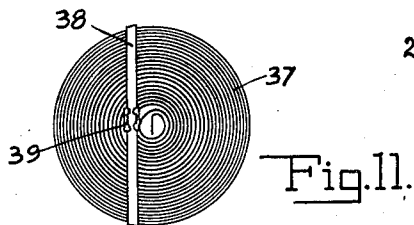
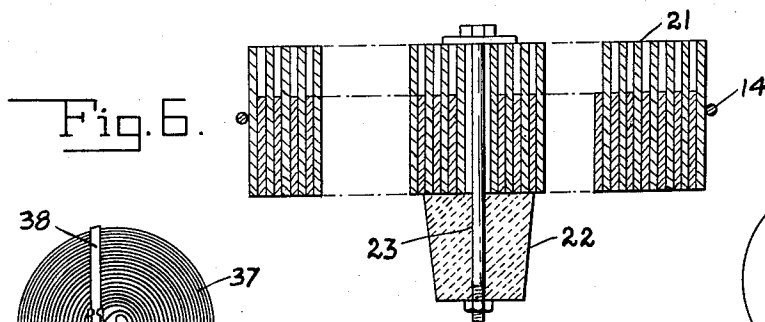
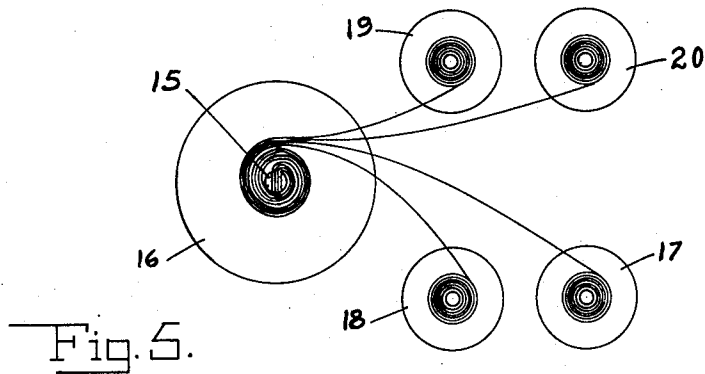
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INGOT MOLD MATS

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INGOT MOLD MATS

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2 Claims. (Cl. 22—139)

This invention relates to protective mats designed to be placed in the bottom of ingot molds, and to a method of making the same, and is for an improved mat for this purpose which may be of lighter weight and more effective than mats heretofore provided, and which may be more economically manufactured. The invention further provides for the anchoring of the mats to prevent floating.

The use of a protective plate or mat at the base of an ingot mold is now a common expedient in casting ingots. Sometimes a flat metal plate is used, but such plates are not satisfactory because the metal, when it initially hits the plate, splashes and erodes the lower portion of the mold, and the plate does not accomplish the cooling of the metal as quickly as desired. It has also been proposed to have mats made in part or entirely of corrugated strips. Such mats are effective, first, because they provide crevices between the corrugations into which the hot metal will flow, and almost immediately freeze, thus accelerating the solidification of the metal across the bottom of the mold, and also because of the more porous character of such a mat, the splashing is reduced. Such mats being formed of metal strips of uniform width despite their effectiveness, are relatively heavy and expensive.

According to our invention, a mat is provided by coiling together two or more strips of different widths. The strips are preferably arranged in such a way that the bottom edges of all of the strips are in a plane making a mat having a substantially flat, solid bottom, while the top of the mat is provided with a groove or grooves formed between the convolutions of the strips. Such a mat more effectively reduce the splash of the metal and erosion in the bottom of the mold. Also it provides considerable extended or fin area for conducting heat from the molten metal into the base of the mold or mold stool, while the substantially flat base of the mat provides a large area of heat contact between the mat and the bottom of the mold or the mold stool. Not only is such a mat highly effective, but it has the further advantage of reducing the overall weight of the mat, in that by making one of the strips narrower than the other, a substantial amount of metal can be eliminated while giving increased effectiveness. These mats not infrequently have diameters of sixteen inches or more, and the reduction in overall weight is a substantial factor. The primary object of the invention therefore is to provide an improved mat, and one which is more economical.

Also through the use of the invention, several strips may be coiled together at one time, so that the mats may be wound more rapidly, and because of there being a multiplicity of coils, each coil is consumed less rapidly so that coils of stock on the machine do not have to be renewed as frequently and the "down" time of the machine is thus decreased and the labor reduced.

A further object of the invention therefore is to provide an improved method of making such mats.

Our invention also provides other improved forms of mats designed to resist floating and reduce splash, and

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a further object is to provide for the anchoring of the mat in the bottom of the mold.

Our invention may be more fully understood by reference to the accompanying drawings, in which:

5 Fig. 1 is a transverse section through a mat embodying our invention, the portions of the mat being broken away;

Fig. 2 is a similar view of a slightly modified form of mat;

10 Fig. 3 is a similar view of a further variation;

Fig. 4 is a similar view of another modification;

Fig. 5 shows schematically the method of winding the several strips together;

15 Fig. 6 is a transverse vertical section through a mat with a plug attachment thereon, the plug being shown in elevation;

Fig. 7 is a view partly in section and partly in elevation of a mat with a hood-like structure thereover having downwardly and outwardly sloping walls;

20 Fig. 8 is a plan view of the disk or plate of a form of machine for practicing a further embodiment of our invention;

Fig. 9 is a side elevation of a pin designed to form the center of a mat for use with the disk or plate shown in 25 Fig. 8;

Fig. 10 is a vertical section through a plug intended to be used with the pin of Fig. 9, and which is a modification of the plug shown in Fig. 6; and

30 Fig. 11 is a plan view showing a novel construction for holding the mat from unwinding.

Referring first to Fig. 1, the mat is a disk-like body comprised of convolutions of metal wound upon one another. As here shown, the mat is formed of one or more wide strips designated 2, and one or more narrow strips designated 3, the wide and narrow strips being alternated outwardly from the center of the mat. By reason of this arrangement, relatively deep grooves 4 are formed in the top surface of the mat, into which the molten metal may flow and be quickly chilled while the bottom of the mat is closed as indicated at 5, providing a large area of contact to rest against the bottom of the mold or the mold stool.

In the arrangement shown in Fig. 2, the mat is formed of wide strips 6, intermediate strips 7, and narrow strips 8. There is a narrow strip 8 between each convolution of the wide strip 6 and the intermediate strip 7. Such a mat provides primary grooves 8' between the widest strips, and supplementary grooves 9 at the bottom of the primary grooves 8'. For each convolution of the wide strip, which of course weighs the most per foot, there are three convolutions of narrower strips which weigh less per foot. Consequently such a mat is economical as to the amount of metal which is used, and has less weight per unit of area than where all of the strips are the same height, and it even has less weight per unit of area than the mat shown in Fig. 1. At the same time both the mat shown in Fig. 1 and Fig. 2, by providing relatively deep grooves, retard the splashing of the metal, and reduce the erosive action of the metal around the bottom of the mold and on the mold stool.

In Fig. 3 the mat may be of the construction shown in Fig. 1 or Fig. 2, except one or more of the strips may be corrugated or indented so that additional crevices are formed in the body of the mat. This further reduces the overall weight of metal. In Fig. 3 the narrow strips 3' are corrugated and the wide strips 2' are smooth, but this condition may be reversed, or all may be corrugated or roughened, and as above explained this variation is applicable also to Fig. 2, and to other forms of mats 70 herein shown.

In the construction in Fig. 4, the mat may be made as shown in Figs. 1 or 2, but it differs therefrom in that

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at the periphery there are a few convolutions of strips much wider than the strips comprising the central area of the mat. In this view the central area may be of the form shown in Figs. 1, 2 or 3, but is shown as having wide and narrow convolutions 10 and 11 respectively, and at the periphery are much wider convolutions of different widths, the highest ones being designated 12, and the lower ones 13. The higher convolutions constitute splash guards and guards to retard the radial flow of the first metal against the stool and mold walls. While the outer convolutions could be all one width, they are preferably wide and narrow.

In all forms of the mat there may be a tie wire 14 about the mat as a means to keep it from unwinding.

Referring to Fig. 5, these mats are commonly formed by unwinding metal from a coil, which metal is usually scrap metal produced from trimming the edges of rolled sheets. The metal which is thus removed from the coil is delivered to a reel which winds it up to form the mat of the desired size. In Fig. 5, 15 designates the reel which is power-driven in the usual way, and which may have a flat plate 16 against which the metal is wound to keep the metal in a plane as it is being wound. According to our invention, there may be several supply coils, as for example four designated 17, 18, 19 and 20. To make the mat shown in Fig. 1, the supply coils 17 and 19 may be coils of wide strip, and the coils 18 and 20 may be coils of narrow strip. To make the mat shown in Fig. 2, coil 17 may be the widest strip, coils 18 and 20 are of the narrowest strip, and coil 19 is the strip of intermediate width. The strips from these four coils are simultaneously wound on the reel 15 into the mat. The forming of the metal into mats is accomplished very quickly, because each turn of the reel 15 will apply four convolutions of strip to the mat being formed, so that the mat builds up quickly to the desired diameter. At the same time less footage of metal is required from any individual coil so that the coils 17, 18, 19 and 20 are individually exhausted less rapidly. Therefore these coils do not have to be replaced as often as where only one or two strips are used in making a mat, and the "down" time of the machine for the purpose of replacing the coils and securing the end of one coil onto the end of another is substantially reduced.

Our invention provides therefore an improved mat in that the upper surface of the mat more effectively reduces splashing and breaks up the flow of the metal and brings about a quick freezing, and it also provides a mat having a good heat conducting contact with the surface on which it is put, by having the bottom of the mat substantially flat and solid. Also mats of a given area made with the present invention are lighter in weight per unit of area than mats made from strips of one width, and even if one or more of the strips is corrugated or roughed, the mat, by reason of having wide strips extending above the narrow ones, is more effective.

In Fig. 6 we have shown a further improvement applicable to this mat as well as to others to resist floating. In this figure, the mat designated 21 may be of any of the forms herein shown, and attached to the under face is a body or plug 22 which may be of metal or ceramic. If it is of metal, it may be welded or bolted to the center of the mat, and if of ceramic it may be secured by a bolt, or pin of some kind, or secured thereto by a cement, and in fact the term "ceramic" is intended to include a body made entirely of a hydraulic cement. In Fig. 6 the plug 22 is secured in place by a metal pin or bolt 23 passing through the center of the mat and secured to the body 22 either by friction, cement, or by a nut as shown.

This plug may be frictionally fitted into the plug hole of a big end up ingot mold having only a plug hole in the bottom, or the mold stool may be recessed to tightly receive it, the plug being tapered with the smaller end down so as to frictionally fit into the hole into which it is forced. This plug will effectively prevent the mat

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from floating. It is an especially desirable feature for expensive alloy steels where a "floaters" usually means a considerable loss.

In Fig. 7 we have shown a mat of the construction shown in Fig. 4, but with the outer sides relatively somewhat higher than shown in Fig. 4. The mat after being so formed has then been pressed by a die having a cone-shaped cavity, preferably corrugated, folding the outer sides into a cone-shaped cover or semi-cover over the mat. The mat is here designated 24, and 25 is the inverted conical cover. This form may be especially useful in deep molds where the metal might otherwise splash quite high. The inverted cone tends to reduce the splash since the metal splashing from the surface of the inverted cone will in a large measure move downwardly and outwardly. The corrugated die forms corrugations in the cone which deepen toward the top to accommodate the inward deformation of the metal. One such corrugation, of which there would be several, is indicated at 26. This form shown in Fig. 7 may have a plug thereon as shown in Fig. 6.

In Fig. 8 we have shown a winding disk of a machine for forming the mat, this winding disk being generally similar to the disk 16 in Fig. 5. It is, however, designated 30, and it is provided at its center with a square or other non-circular recess 31. It is also shown as having a shallow groove 32 traversing its face a short distance to one side of the center.

The square socket 31 in the disk 30 is designed to removably receive the non-circular or square head 33 of a split pin 34 shown in Fig. 9. This split pin may be of a length substantially equal to the thickness of the mat, in which case it serves only as a starting core for the winding of the mat and forms a solid core at the center of the mat when the mat is finished, or as shown, it may be longer to project beyond the face of the mat, in which case the projecting end of the pin may be roughened on its exterior surface as shown. The end of the strip metal to be rolled into a mat is placed in the bifurcation of the stem 34 of the bolt or pin, and when the disk 30 is rotated the pin 34 will also rotate, causing the metal to be wound upon the pin. When the operation is finished the mat with the pin attached and already in place at the center is then lifted away from the face of the disk, and the projecting end which is roughened or barbed may be forced into the socket 35 of a plug 36, this plug corresponding in general construction and purpose to the plug 22 shown in Fig. 6. The attachment of the plug to the pin can be made either when the mat is formed, or at the time the mat is to be used.

When the mat has been wound on the disk 30 in the manner described, a strap of metal may be passed along the groove 32 on the face of the disk, and in so doing it will pass under the mat. The ends of this strip of metal may then be brought together and crimped or welded. This is shown in Fig. 11, where the mat is designated 37 and the strap 38, while the joint connecting the two ends of the strap is designated 39. The mat when coiled is under considerable tension and exerts a substantial pressure, tending to unwind. Because the strap is off center as shown in Fig. 11, the unwinding force tends to pull the strap tighter and draw it toward the center of the mat, but since it cannot stretch, it resists movement in this direction, thus effectively holding the mat from unwinding. This arrangement for holding the mat from unwinding may be used in place of the wire 14 in the other forms of mats herein illustrated, with the exception of the one shown in Fig. 7, and it provides a cheap, effective way of preventing the mat from uncoiling. The mat may be formed of several strips and of different widths, as herein described, or may be a single coil of metal.

The several embodiments herein specifically shown and described are illustrative of our invention, and it will be

apparent that the construction may be varied and the mats may be elliptical instead of round, all as contemplated within the scope of the appended claims.

We claim:

1. An ingot mold insert mat comprising a body formed of metal strips of at least two different widths wound together into a coil-like mat with the wide and narrow strips alternating and the convolutions being tightly coiled, the bottom edges of the strips all being in a substantially common plane, the coil being a flat disk-like body having a diameter greater than its maximum height.

2. An ingot mold insert mat comprising a body formed of at least four metal strips of three different widths coiled together with the convolutions in contact, two of the strips being narrow, one intermediate, and one wide, and

with two of the strips of narrowest width being interposed between the intermediate and widest strips.

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