(No Model.)

# R. SLEETH.

## MOLD.

No. 384,595 Patented June 12, 1888.

FIG. 1.

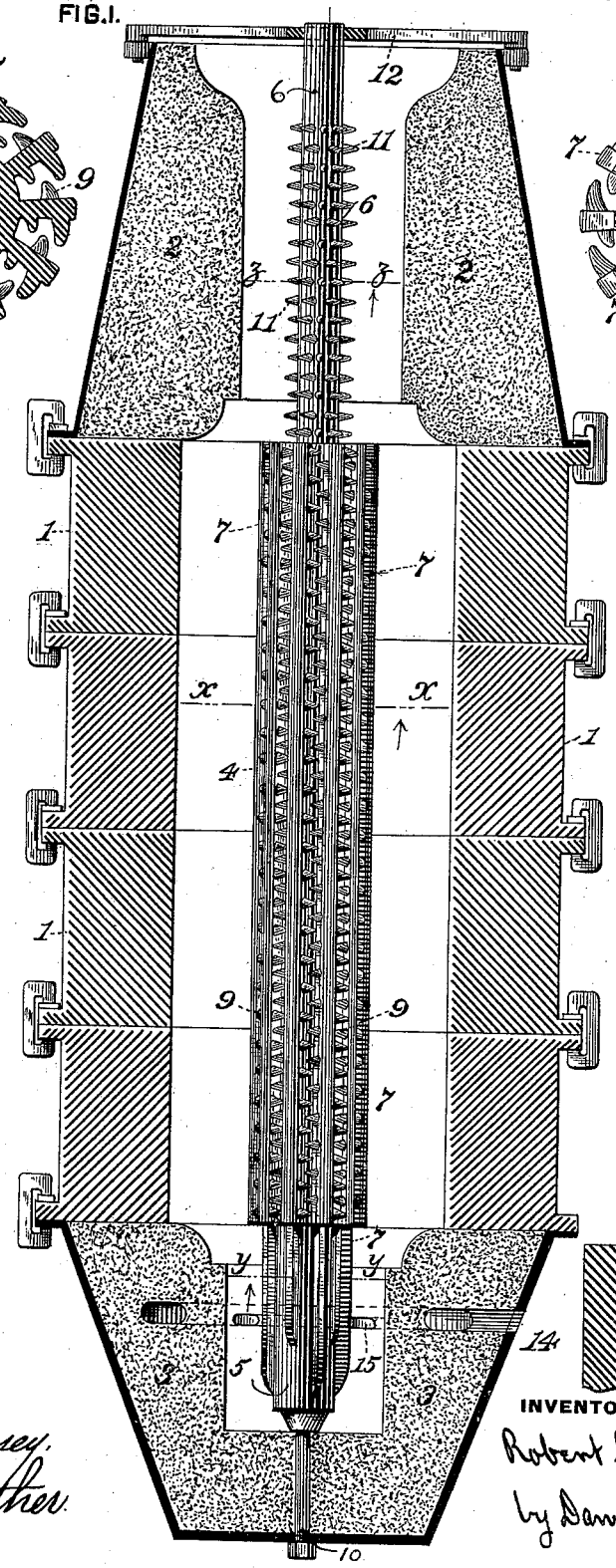



FIG. 2.

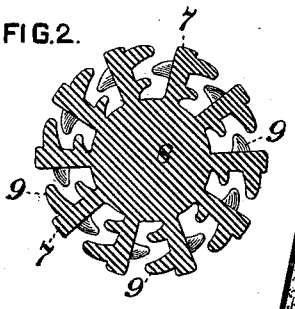



FIG. 3.

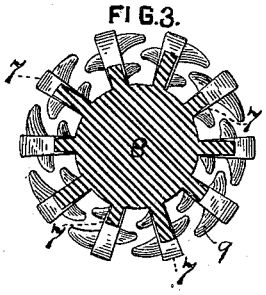



FIG. 4.

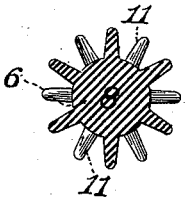
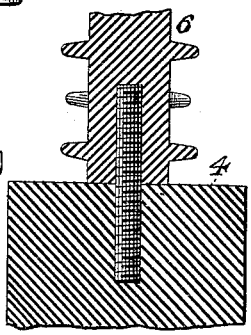



FIG. 5.

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# UNITED STATES PATENT OFFICE.

ROBERT SLEETH, OF PITTSBURG, PENNSYLVANIA.

## MOLD.

SPECIFICATION forming part of Letters Patent No. 384,595, dated June 12, 1888.

Application filed April 2, 1888. Serial No. 269,336. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT SLEETH, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Molds, of which improvements the following is a specification.

The invention described herein relates to certain improvements in molds for the manufacture of rolls, cannon, and other articles which are formed of iron or steel cast in molds formed wholly or in part of metal.

As is well known to those skilled in the art, the sudden cooling of molten cast iron or steel produces fine closely-compacted crystals in the portions of the mass in nearest proximity to the chilling medium, and that in the parts of the casting farther away from the chill the crystals become larger and less dense. While not asserting positively that such is the case, it seems that the sudden cooling of the molten metal prevents the full crystallizing tendency thereof and results in the formation of very small minute crystals, which naturally assume a closer or more intimate contact with each other. In casting chilled rolls and other analogous articles this exterior shell, formed by the contact of the molten metal with the chill, is subjected to the outwardly-acting pressure of the column of fluid metal inclosed by the shell, and as such pressure is sufficient in large rolls to prevent the inward movement of the shell during solidification the shell is ruptured, thereby destroying the roll.

The object of the invention herein is to effect at least an approximate equalization of the contraction in different parts of the casting, and also to relieve the shell, formed, as above stated, by the contact of the molten metal with the chill, of the outward pressure of the column of fluid metal inclosed by the shell.

In the accompanying drawings, forming a part of this specification, Figure 1 is a sectional elevation of a mold for casting chilled rolls having my internal chill arranged therein. Figs. 2, 3, and 4 are transverse sectional views of the internal chill on the lines *x x*, *y y*, and *z z*, Fig. 1; and Fig. 5 is a sectional detail view showing the manner of joining parts of the internal chill.

For the purpose of description my invention is shown as employed in the manufacture of chilled rolls; but said invention is equally applicable for the manufacture of other analogous articles whether externally chilled or not.

The mold, which is of the usual construction, consists of the annular chills 1 and the cope 2 and drag 3, having the matrices for the necks of the roll formed therein. Within this mold, prior to casting, the internal chill or "cooler," as I term it, is placed, said chill or cooler consisting of the body portion 4 and the end portions, 5 and 6. This chill or cooler, which is preferably formed of the same grade and kind of metal as the body of the roll, may be made of any desired cross-sectional contour or shape, care being taken to provide sufficient body and exposed surface to effect the desired internal chilling or cooling action. With such purpose in view the body portion 4 consists of a series of projections, preferably in the shape of flanges or wings 7, radiating from a central shaft or stem, 8, thereby providing a large exposed surface, which is further increased by nodules or horns 9, formed on the faces of the wings, as shown. The lower portion, 5, of the chill may be formed integral with the body portion, or may be separately formed and subsequently attached to said body portion by a threaded stud screwing into adjacent ends of the two portions, as shown in Fig. 5. This lower portion, like the body portion, consists of a central shaft and radiating projections or wings, only alternate wings, however, extend down to or into proximity to the lower end of the portion 5, the other wings stopping about midway of the length of the portion 5. This arrangement of the wings without the nodules is employed for the reason that the central shaft tapers toward its lower end, and hence the wings would be unnecessarily crowded were all of the wings extended to the full length of the shaft. The wings also are gradually reduced in width toward the lower end of the portion 5. A bolt, 10, or other suitable device, is attached to or formed on the lower end of the portion 5 for the purpose of securing the chill to the bottom of the mold, as shown, thereby preventing the chill from being buoyed by the molten metal.

The upper end, 6, of the internal chill consists of a central shaft or stem, 8, provided with radiating studs 11, which extend along a portion only of the shaft, the upper end thereof being made plain and comparatively smooth

in order that it may move freely through the guide-ring of the spider 12, secured to the top of the mold, as shown, for the purpose of holding the chill centrally within the mold. The part 6 of the chill may be formed integral with the body portion 4, or it may be connected therewith by a threaded pin or bolt, as described in connection with the lower portion 5.

As shown in Fig. 1, the body portion 4 is made of a length approximately equal to the portion of the roll to be chilled externally, and the end portions, 5 and 6, are made of a length approximately equal to the length of the necks of the roll. A vertical runner (not shown) is arranged alongside of the mold, and is connected by the channel 14 with the sprues 15, arranged tangentially around the matrix for the lower neck of the roll, so as to impart a swirling or rotary motion to the metal for the purpose of throwing the better metal to the outer portions of the mold.

The wings on the lower portion, 5, of the chill will stop the swirling movement in the center of the mold while permitting of its movement along the outer walls thereof, as otherwise the cutting action of the rapidly-moving metal cut through the portion 5 and permit of the chill or cooler being buoyed up by the molten metal, and thus rendered inoperative as regards a part, at least, of its functions. As the metal flows upward through the mold, it comes in contact with the external chill and internal chill or cooler at the same time, thereby initiating two solidifying and contracting actions at different points, but both acting in the same direction—*i. e.*, toward the center or axis of the roll. The contraction resulting from the solidification of the metal by contact with the external chill tends to compress the molten or semi-molten mass, while the contraction due to contact of the molten metal with the internal chill or cooler tends to draw the metal between it and the outer shell in the same direction, thereby to the full extent of the contraction due to the solidification by contact with the internal chill or cooler relieving the external shell of the outward pressure of the fluid, and drawing the interior mass of metal toward the center, and permitting to the extent of such inward draft the external shell to move inwardly with comparative freedom. The inward pressure of the external chilled shell will tend to force the molten metal at the center of the roll upward, as that is the only direction in which it is free to move; but the weight of the fluid-column may be, and generally is, so great as to overcome the tenacity of the external shell, which will then be ruptured. In the use, however, of my internal chill or cooler the metal as it flows in and around the various projections in both the body and the upper neck portions of the chill becomes welded and adheres thereto, so that on the elongation of the internal chill or cooler, due to its increase in temperature, the metal of the roll around and adjacent to the chill is raised, thus facilitating the upward movement of such metal, due to the inward pressure of the external chilled shell, and relieving said shell of such pressure and permitting its inward movement to the extent of the upward movement of the fluid-column, due to the expansion of the internal chill or cooler; and, further, this upward lifting of the metal around the axis of the roll lessens to a great degree the formation of a "pipe" or cavity at the upper end of the casting, and thereby avoids the necessity of large sinker-heads when making large castings.

While I have shown and described my invention as applied to the manufacture of chilled rolls, it is equally applicable to the formation of rolls having an unchilled surface, and also to the manufacture of other articles, whether chilled or not, as shafts, pinions, cannon, ingots, &c.

I am aware that rolls have been formed having wrought-iron bars incorporated therein for the purpose of strengthening the rolls, especially as regards the neck portions thereof, and also that rolls have been formed having pipes incorporated therein for the purpose of passing a heating-fluid through the roll while in use; but in the above cases the bar or pipe was of such comparatively small cross-sectional size as to be practically inoperative for cooling or solidifying the interior metal, and to be wholly ineffective on account of the smoothness of their exterior in lifting the metal at the center, whereas it is necessary in the practice of my invention that the exposed surface of the internal chill or cooler should be comparatively large relative to the size of the roll to be cast in order to produce an effective chilling action, and also that the chill or cooler should be provided with projections, with which the metal will firmly engage when solidifying, in order that the cooler when expanding longitudinally may draw the partially-solidified metal up with it in the manner hereinbefore fully described.

I claim herein as my invention—

1. The combination of a mold for rolls or other analogous articles and an internal chill or cooler provided with a series of wings or projections, substantially as set forth.

2. The combination of a mold for rolls or other analogous articles and an internal chill or cooler provided with a series of radiating wings having nodules or horns formed thereon, substantially as set forth.

3. The combination of a mold for rolls or other analogous articles and an internal chill or cooler provided with a series of wings or projections, and having one of its ends secured as against movement and its opposite end free to move when the chill or cooler is heated by the molten metal, substantially as set forth.

In testimony whereof I have hereunto set my hand.

ROBERT SLEETH.

Witnesses:
R. H. WHITTLESEY,
DARWIN S. WOLCOTT.