5 Sheets—Sheet 1.

J. OLIVER.

Chill for Chilling Mold-Board for Plow.

No. 220,086. **Patented Sept. 30, 1879.**

Fig. 1.

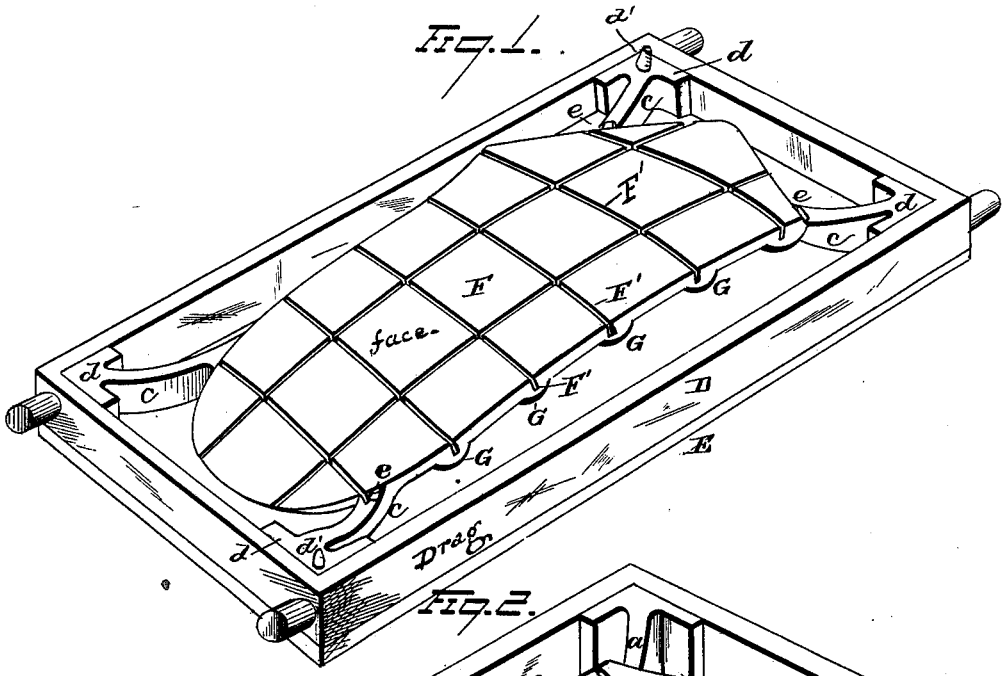
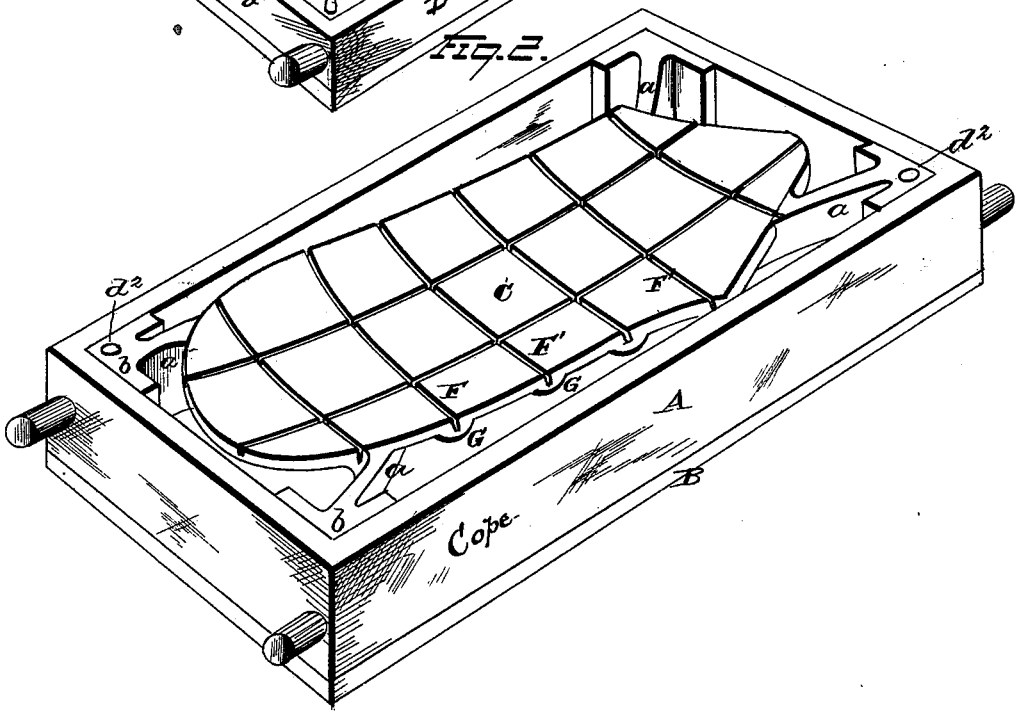


Fig. 2.



WITNESSES

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5 Sheets—Sheet 2.

J. OLIVER.

Chill for Chilling Mold-Board for Plow.

No. 220,086. **Patented Sept. 30, 1879.**

Fig. 3.

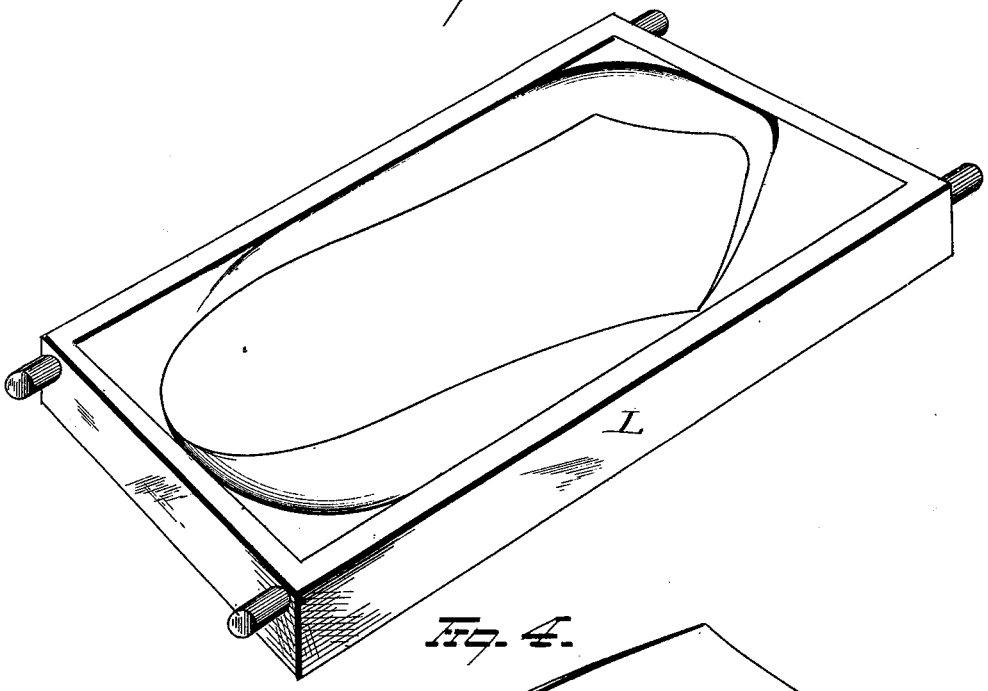
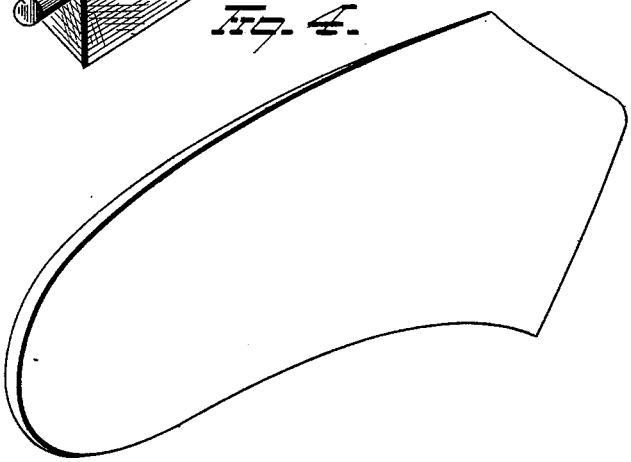


Fig. 4.



WITNESSES
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5 Sheets—Sheet 3.

J. OLIVER.

Chill for Chilling Mold-Board for Plow.

No. 220,086. **Patented Sept. 30, 1879.**

Fig. 5.

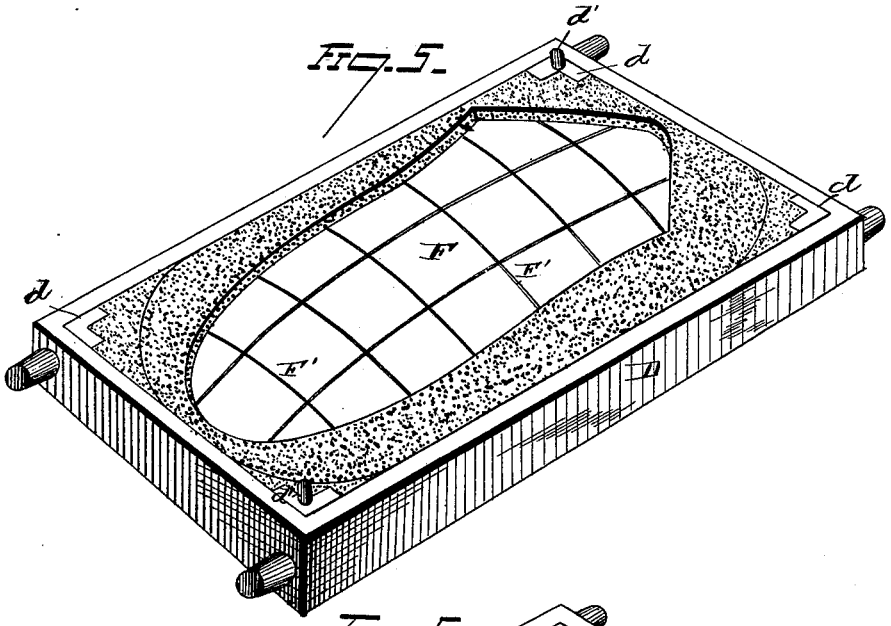
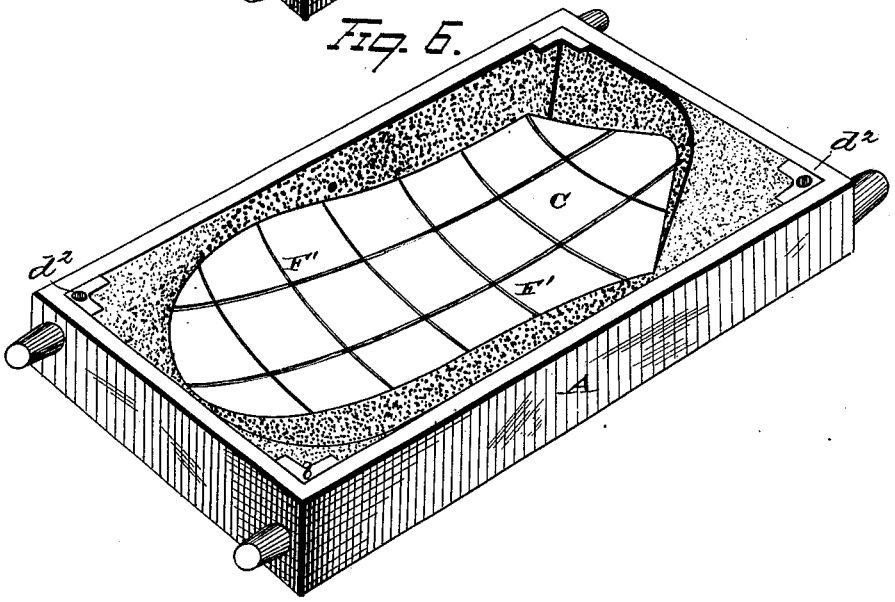


Fig. 6.



WITNESSES

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5 Sheets—Sheet 4.

J. OLIVER.

Chill for Chilling Mold-Board for Plow.

No. 220,086. **Patented Sept. 30, 1879.**

Fig. 7.

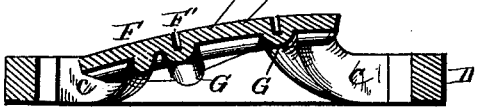


Fig. 8

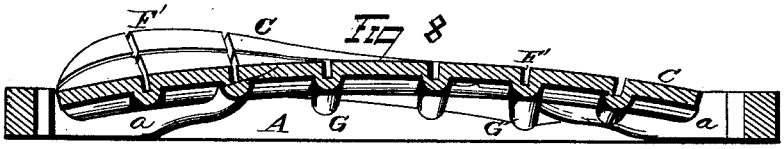


Fig. 9.

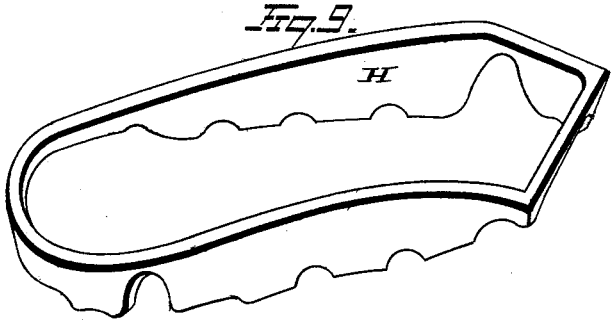
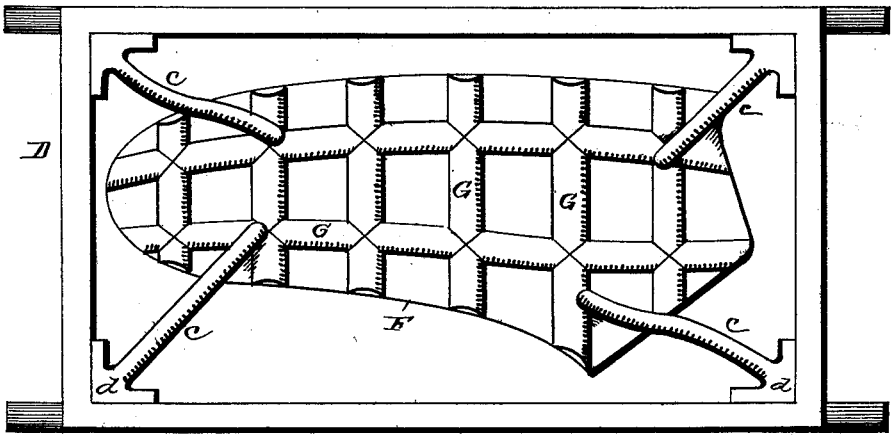


Fig. 10.



WITNESSES

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No. 220,086. **Patented Sept. 30, 1879.**

Fig. 11.

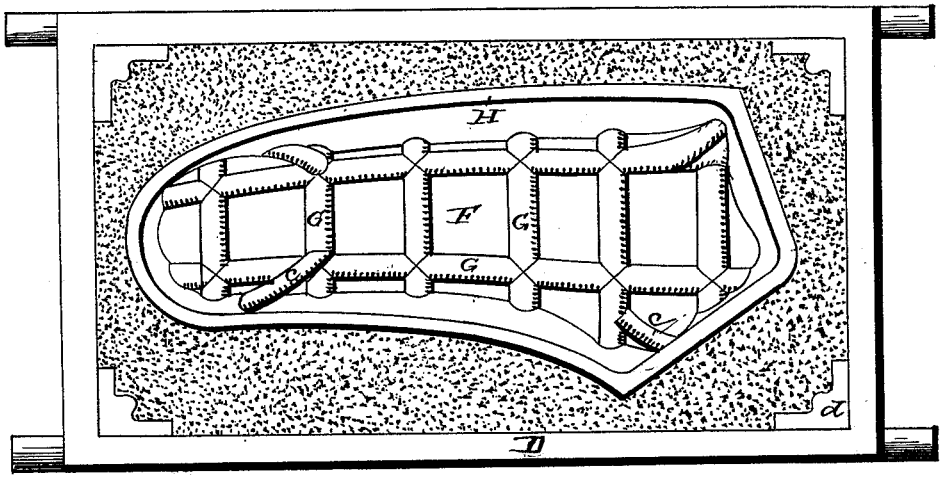
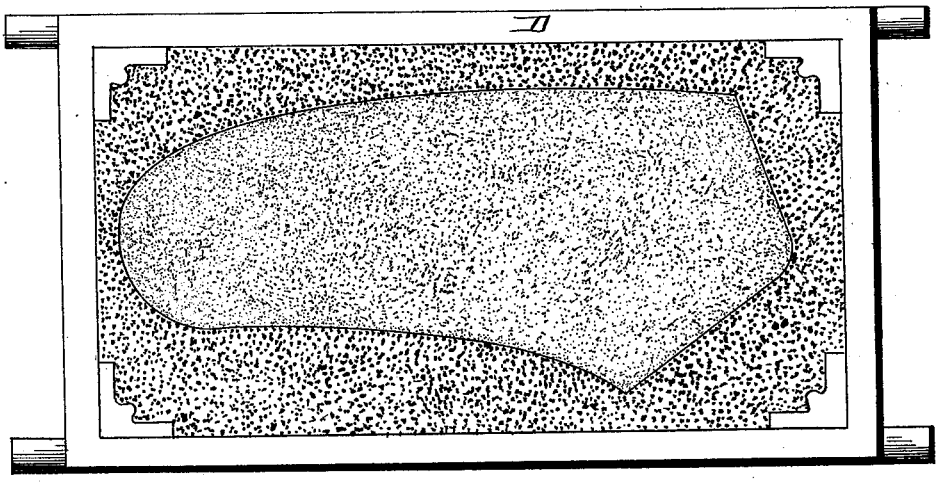


Fig. 12.



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UNITED STATES PATENT OFFICE.

JAMES OLIVER, OF SOUTH BEND, INDIANA.

IMPROVEMENT IN CHILLS FOR CHILLING MOLD-BOARDS FOR PLOWS.

Specification forming part of Letters Patent No. **220,086**, dated September 30, 1879; application filed August 22, 1879.

To all whom it may concern:

Be it known that I, JAMES OLIVER, of South Bend, in the county of St. Joseph and State of Indiana, have invented certain new and useful Improvements in Chills for Chilling Mold-Boards for Plows and other Castings; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in chills for chilling mold-boards for plows and other castings.

Heretofore the chills for chilling the surfaces of iron castings have usually been made of a solid piece of iron, the face of the chill conforming to the shape of the face of the article to be cast and chilled. Chills made in the above manner have been found very objectionable and defective in practice, especially when the article to be chilled is comparatively thin and of irregular form—as, for instance, a mold-board for plows—for the reason that when the melted iron of which the resulting chilled casting is to be made is poured into a flask and flows over the chill-face the said chill-face is heated to a much higher temperature than the back side of the chill, over which no molten iron is poured. The great heat of the molten iron as it comes in direct contact with the face of the chill operates to expand the face of the chill to a greater extent than the rear surface thereof, and the unequal expansion of the face and rear side of the chill operates to warp and twist the chill to an extent that produces distorted castings that are not in conformity with the patterns, and hence, in many cases, are useless for the purposes intended.

Again, chills have been made with a receptacle formed on their rear faces for holding hot water to equalize the temperature of the opposite surfaces of the chill, and thereby prevent the latter from warping and distorting the chilled casting.

Chills of the character last referred to were patented by me as follows: Patent No. 150,882, granted May 12, 1874, and No. 175,662, granted April 4, 1876. While chills of this form and construction constituted an improvement upon the ordinary form of chill, yet they were found objectionable in use, owing to the complex apparatus and high degree of skill required in their proper manipulation and to the increased space and time required in using the same.

Further, chills have been made in sections, each section being made of a length equal to the width of the article to be chilled. This latter form of chill is shown, described, and claimed in Letters Patent No. 86,579, granted to me February 2, 1869, and reissued March 11, 1873, No. 5,321. Chills thus made have the effect to a considerable extent of preventing the undue warping of the chills, and also serve to vent the face of the chill and allow of the free escape of the gases generated when the molten iron is poured into the flask and against the face of the chill. Yet the sectional chill has been found lacking in several desirable features which are wanting in a perfect chill. While the several sections were adapted to expand and contract independently of each other, the sections, being made to extend throughout the width of the chilled surface of the article to be cast, would sometimes curl slightly or twist, and thereby distort the casting, and also be rendered unfit to be again used.

Again, in sectional chills apertures are formed le adingfrom the face to the rear surface of the chill, and this construction proved objectionable, as, in the event that dry sand should be desired for use against the rear surface of the chill, particles of the sand would sift through such apertures and become embedded in the casting.

Further, chills have been made with a series of grooves or depressions of sufficient width and depth to admit the molten metal when poured, and thus form cleats and braces on the chilled surface of the casting, the cleats or braces operating in a measure to prevent the casting from warping while being cooled. This latter form of chill is covered by Letters Patent No. 189,874, granted to me April 24, 1877.

While the construction of chill last described is capable of effecting certain improved results, yet it is not adapted to produce chilled

castings with perfectly smooth chilled faces, which form of castings are desired, and, in fact, demanded in many kinds of castings.

Having given a full history of the prior state of the art in chilling the faces of castings, I will now state that the object of my invention is to obviate the several, and in some cases important and essential, defects and objectionable features existing in chills as heretofore constructed, and provide chills for making chilled castings which will allow the face of the chill to expand and contract practically independent of the degree of contraction and expansion of the metal composing the rear surface of the chill, and prevent the warping of any portion of the chill and the distortion of the chilled casting, and, further, a chill having an imperforate and solid backing, which shall serve to exclude any foreign substances from the cavity within which the metal is to be poured, and render the chill easy of manipulation and not liable to become broken or impaired in use.

To this end my invention consists, first, in a chill having a solid back and its face provided with channels of sufficient depth to allow of the independent expansion and contraction of each section of the face of the chill, the channels being made of such width as to prevent the molten metal from entering therein.

My invention further consists in several other details of construction and combinations of parts, as will hereinafter be explained and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view, in perspective, of the drag having one of my improved chills attached thereto. Fig. 2 is a view, in perspective, of the cope provided with another chill, which is attached thereto. Fig. 3 is a view, in perspective, of a follow-board to be employed in molding. Fig. 4 is a view, in perspective, of the pattern and also of the chilled article. Figs. 5 and 6 are views, in perspective, of the drag and cope after they have been rammed up with molding-sand. Figs. 7 and 8 are transverse and longitudinal sections of one of the chills. Fig. 9 is a view, in perspective, of the form or removable partition-flange to be applied to the rear face of the chill. Fig. 10 is a plan view of the rear side of the drag, the bottom board of the flask having first been removed. Fig. 11 is a plan view of the rear side of the drag after the molding-sand has been properly rammed up therein; and Fig. 12 is a similar view of the drag after the dry sand has been inserted within the opening formed by the partition-flange.

A represents the cope, and B the bottom board of the cope. C is a chill for chilling the rear surface of a mold-board, and is constructed with the arms *a* formed solid therewith, said arms being provided with angle-braces *b*, which fit the corners of the cope-frame and afford means for firmly securing the chill to the cope in such a manner as to provide an open space all around the chill for filling with sand in preparing the mold for casting the mold-board.

D represents the drag, and E the bottom board of the drag.

F is a chill for chilling the face of a mold-board for plows, said chill being provided with arms *c*, formed solid with the chill. Arms *c* are provided on the outer ends with angle-braces *d*, which snugly fit the corners of the drag-frame, and are secured thereto, and thus form an open space around the entire edge of the chill for chilling the sand. Arms *c* (two or more) are furnished with pins d^1, which are arranged to enter holes d^2, correspondingly located in the arms *a*, so that when the cope and drag are secured together they will exactly register, and thereby cause the two chills to be properly located for casting the mold-board.

The two chills are kept at the desired distance apart, to insure the desired thickness of the mold-board to be cast, by means of pins *e*, lugs, or equivalent means, attached to the arms *c*. The supporting-arms connected or formed solid with the chills therefore serve a fourfold purpose when two chills are employed, to wit: They serve, first, to provide an open space around the outer edges of the chill, which space is filled with sand; second, to retain the chills against displacement in molding and casting; third, to serve as rests and cause the chills to exactly register with each other when the cope is secured to the drag; and, fourth, to provide bearings in close proximity to the chills for spacing pins or lugs, to insure the desired thickness of the article to be cast.

The chills are made of different thicknesses, according to the size and thickness of the article to be cast, the thickness varying from one-half inch to an inch or more. The chill is made in one solid piece, as usual, and in form and size to correspond with the desired form and size of the face of the article to be chilled.

In the face of the chill I cut intersecting channels F′ of a depth greater than the heat of the melted iron used to form the chilled casting will penetrate before the casting will become solidified to such an extent as to preclude its becoming warped or distorted in shape. The intersecting channels F′ in the face of the chill form independent chill face-sections, which may be of any required shape or size, according to the character of the chilled casting to be produced. Channels F′ are made sufficiently narrow to prevent the molten metal from entering therein. As the molten metal comes in contact with the face of the chill, the metal is cooled to such an extent that it will not flow into a narrow channel formed in the face of the chill, and hence I take advantage of this ascertained fact in forming the channels F′, and consequently make such channels of the greatest width possible to be used without allowing the molten iron to flow into the channels and produce ribs or

cleats on the chilled face of the casting, as instanced in my patent No. 189,874, the object of this invention being to produce perfectly-smooth chilled face or faces on the chilled casting.

When the castings are large and of considerable thickness, the channels F′ should be made of considerable depth, in some cases being made to extend three-quarters through the thickness of the chill; also, the channels in such cases should be located quite near to one another to form independent chill face-sections of comparatively small area, in order that every portion of the face of the chill may be allowed to freely expand and contract, and thus obviate all danger of warping or twisting the chill and distorting the shape of the casting.

In order to secure solid chills which shall possess the independent chill face-sections of the character hereinbefore described, and yet be made of minimum weight to facilitate the manipulation of the flasks, I form the chills with ribs G on their rear surfaces, said ribs being made to intersect each other, and located in exact conformity to the desired location of the channels F′ in the face of the chill. In such construction of chill the channels F′ may be made of a depth quite equal to the thickness of the body portions of each chill-section, and, in fact, may be made of a depth that shall exceed the thickness of the body portion of the chill-section, if so desired. Hence, by providing the back or rear face of the chill with re-enforcing ribs, it allows of the face of the chill being subdivided into independent chill face-sections insulated from each other by channels of any desired depth. Again, the ribs serve another useful purpose, in that they impart increased strength and stiffness to the entire chill, and thus operate to resist, in a great measure, any tendency of the chill to warp or twist out of shape. Still another advantage results from the employment of ribs on the rear face of the chill the face of which is intersected with channels of the character described, which is as follows: The ribs constitute a re-enforcing frame of metal bordering the rear side of each face-section of the chill, and as these ribs are located at a greater distance from the face of the chill than the rear surface of the body portion of each chill-section, they will remain comparatively cool when the face-section has been heated by the direct contact of the molten metal as it is poured thereon; hence the network of ribs re-enforcing the back of the chill remains undisturbed and unaffected by the heat of the molten metal, while the chill face-sections are allowed to expand and contract independently of one another without warping or twisting the chill.

While I have described the benefits and advantages resulting from the employment of ribs on the rear face of a chill which is provided with channels of the character described formed on its face, I would have it understood that I do not restrict myself to a chill provided with such ribs, as they may be dispensed with, and greatly-improved results be obtained by the employment of a solid chill provided with a channeled face and having a plain rear surface.

H represents a ring, made of any suitable material, which is to be placed on the back of the chill when the sand is rammed in the flask. The ring H is made with its lower edge conforming in shape to the back of the chill, and the sides of the ring are made to conform to the outlines of the edge of the chill, but are made of less dimensions, so that when the ring is placed on the back of the chill the edge of the latter will project outwardly beyond the ring H, all around the outside thereof.

In height the ring H corresponds with the upper edge of the flask which holds the chill. The ring H is preferably made slightly beveled outward from its lower to its upper edge, to enable the ring to be readily withdrawn from the sand, as will be hereinafter explained.

Having described the construction of the several parts of my improved chills, I will now describe the method of making chilled castings by means of their employment.

The pattern represented in Fig. 4 is placed upon the follow-board shown in Fig. 3. The drag is then placed over the follow-board, the face of the chill secured thereto, resting upon the upper face of the pattern. The ring or removable partition-flange H is then placed upon the rear surface of the chill. Damp sand in its usual condition for molding is then rammed up within the space between the ring H and the sides of the drag-frame. Thus the damp molding-sand is rammed up in contact with the margin of the chill that projects outwardly from the ring H, and also around the outer edge of the chill and pattern placed thereon, so that the face of the chill and drag, after the pattern has been removed, will appear as represented in Fig. 5 of the drawings. After the damp sand has been rammed up, as heretofore explained, the surplus sand is struck off level with the top or rear edge of the drag, as represented in Fig. 11. The bottom board E is then placed on the drag, and the latter turned over and the follow-board L removed. Parting-sand is then sprinkled over the molding-sand of the drag, the pattern being allowed to remain therein, and the cope is then placed on the drag, the guiding-pins of the latter entering the holes formed in the arms connected with the chill in the cope, thus causing the two chills to exactly register with each other. Sand is then rammed up in the cope and over the rear surface of the chill secured therein. Surplus sand is then struck off, the bottom board B secured in place, and cope lifted from the drag. The follow-board L is then placed over the drag and the latter turned over upon the follow-board to deposit the pattern in the follow-board. The drag is then placed on the cope and the ring H withdrawn. The sides of the ring H being in-

wardly beveled, the ring is easily withdrawn from the damp sand rammed up around the outer surface thereof. The open space formed by the withdrawal of the ring is then filled with dry sand, which is allowed to remain until after the flask has been poured.

The object of using dry sand in the manner described is to absorb the moisture of the damp sand surrounding the chills, which, if allowed to remain in its usual moist condition, would generate a vapor that would condense on the chill-faces, and cause imperfections in the resulting chilled castings. The employment of dry sand in the manner above described enables me to dispense with the use of hot water, which has been heretofore used by me for this purpose in connection with chills, and for said process and chills I obtained Letters Patent No. 150,882, dated May 12, 1874.

After the pattern has been removed from the flask, the drag and cope will appear as represented in Figs. 5 and 6 of the drawings.

The sprue and gate are formed in the sand in the usual manner, with which all foundrymen are familiar, and the flask is ready for pouring.

The pins attached to the arms of the chill secured to the drag rest on the arms connected with the chill secured to the cope, and thus is produced the proper and desired intervening space for casting the article desired.

When the melted iron is poured into the flask and over the face of the chills, the heat of the melted iron is first transmitted by contact to the outside of the chill-face only, and from thence into the body of the chill. The face of the chill, therefore, expands in proportion to the degree of heat to which it is subjected; but as it is subdivided into independent face-sections by the intersecting channels, as hereinbefore explained, the expansion of the metal composing the face of each of said sections cannot operate to warp or twist the chill, as each section is sufficiently free and independent of the other sections to expand and contract without changing the shape of the castings from the patterns.

Before the chill can become heated to a depth beyond the depth of the channels therein, the chilled casting has become solidified, and should the chill by any possibility become warped or twisted from the heat of the melted iron, such changes in its form cannot affect the chilled casting, as it will have already assumed a fixed and unalterable shape, which is a counterpart of the form and contour of the chill-face when in its perfect and desired shape, and consequently the resulting casting is true to the pattern. As the chill is made solid, it is provided with an imperforate rear surface or backing, which not only imparts stiffness to the chill and serves to prevent the twisting or curling of any of the independent chill face-sections formed thereon, but it renders the chill easy of manipulation, and not liable to become impaired in use, and, further, allows the use of fine dry sand against the back of the chill.

Chills made as herein described can be used singly to chill but one side or face of a casting, or they may be used in pairs to chill both sides or faces of the casting.

Castings that are chilled on both sides or faces are ordinarily preferable to those chilled on one face only, as there is less tendency to warp when both sides are chilled; and, again, much softer iron can be used in the castings, thus enabling castings of greater strength and toughness to be produced.

Again, the castings can be made with the side that is to be finished, as the wearing-face of a mold-board, downward in the flask, to allow all impurities to rise to the back or rear surface of the article when the metal is poured into the flask, and thus concentrate all the impurities of the metal in that portion of the article, where they will be harmless.

The use of two chills saves labor in molding, and does not require skilled labor to mold up the flask. Further, there is also considerable time saved, owing to the large decrease in the quantity of sand required to be rammed up in the flask. The small quantity used with double chills can be rapidly rammed up by any one possessed of ordinary intelligence, and does not necessitate the employment of skilled molders for such work.

I would have it understood that I make no claim to a solid or a sectional chill having shallow grooves formed in the face of the chill, as such construction of chill is covered by Letters Patent No. 114,469, granted to me May 2, 1871. The shallow grooves in the face of the chill served to ventilate the face of the chill, and to allow of the escape of any vapors or gases generated when the melted iron was poured over the chill.

In my present improvement the channels serve a twofold purpose, to wit: They afford ample ventilating-apertures for the free and ready escape of vapors or gases, and also serve to subdivide the face of the chill into any desired number of independent chill face-sections which will expand and contract without warping or distorting the shape of either the chill or casting.

As many slight changes may be resorted to in details of construction and in the relative arrangement and combinations of parts without departing from the spirit of my invention, I therefore do not limit myself to the exact construction and arrangement of parts shown and described; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A chill for making chilled castings, constructed of a single piece of metal with a solid imperforate back, and its face provided with intersecting channels of sufficient depth, as hereinbefore described, to constitute independent chill face-sections, which will expand and contract without warping or twisting the

chill or casting, said channels being restricted to such width that the molten metal will be excluded therefrom, substantially as set forth.

2. The combination of two chills for chilling the opposite sides of a casting, each of said chills constructed of a single piece of metal with a solid imperforate back, and its face provided with intersecting channels of sufficient depth, as hereinbefore described, to constitute independent chill face-sections which will expand and contract without warping or twisting the chill or casting, said channels being restricted to such width that the molten metal will be excluded therefrom, substantially as set forth.

3. A chill for making chilled castings, constructed of a single piece of metal with a solid imperforate back, the rear surface of the chill provided with intersecting re-enforcing ribs, and the face of the chill provided with intersecting channels of sufficient depth, as hereinbefore described, to constitute independent chill face-sections which will expand and contract without warping or twisting the casting, said channels being restricted to such width that the molten metal will be excluded therefrom, and the channels located directly opposite the intersecting ribs on the rear surface of the chill, substantially as set forth.

4. The combination, with the cope and drag of a flask, of chills secured to the cope and to the drag by means of arms which rest in contact with each other when the metal is poured, substantially as set forth.

5. The combination, with the cope and drag of a flask, of chills permanently secured within the cope and drag by means of arms, the latter provided with pins and holes to cause the chills to register when the cope is applied and secured to the drag, substantially as set forth.

6. The combination, with the cope and drag of a flask, of chills secured within the cope and drag by means of arms, and of pins or lugs attached to the arms of one chill in close proximity to the chill, to support the opposite chill the desired distance therefrom, substantially as set forth.

7. The combination, with a chill for making chilled castings, of a ring adapted to fit against the rear face of the chill and expose the margin of the chill outside the edge of the ring, substantially as set forth.

8. The combination, with a chill for making chilled mold-boards for plows, of a beveled ring adapted to fit against the rear surface of the chill and extend upwardly therefrom flush with the edge of the flask, substantially as set forth.

9. The method hereinbefore set forth of forming a chill-mold, consisting in ramming up the flask with damp sand around the outer portion of the chill and packing dry sand against the central portion of the rear surface of the chill.

In testimony that I claim the foregoing I have hereunto set my hand 9th day of August, 1879.

JAMES OLIVER.

Witnesses:

LUCIUS HUBBARD,

J. D. OLIVER.