(No Model.) 3 Sheets—Sheet 1.

C. F. BRUSH.

MOLD FOR CASTING METALS.

No. 293,710. Patented Feb. 19, 1884.

Fig. 1.

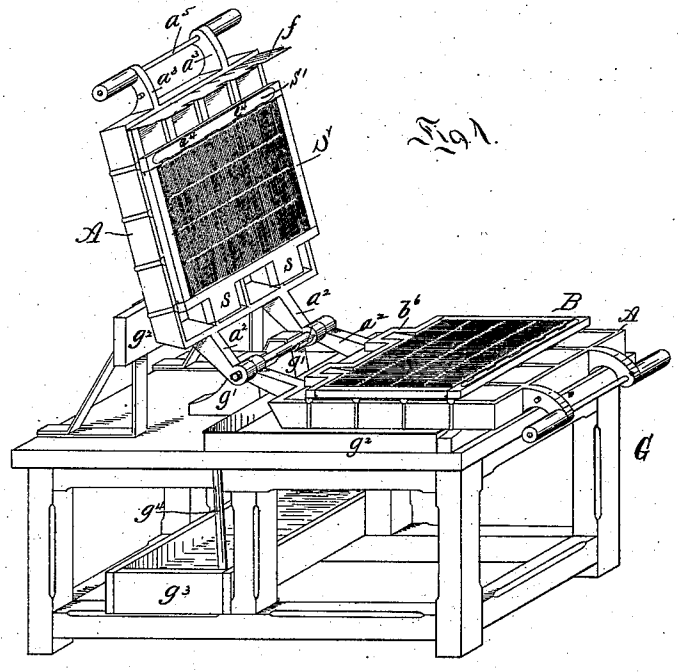
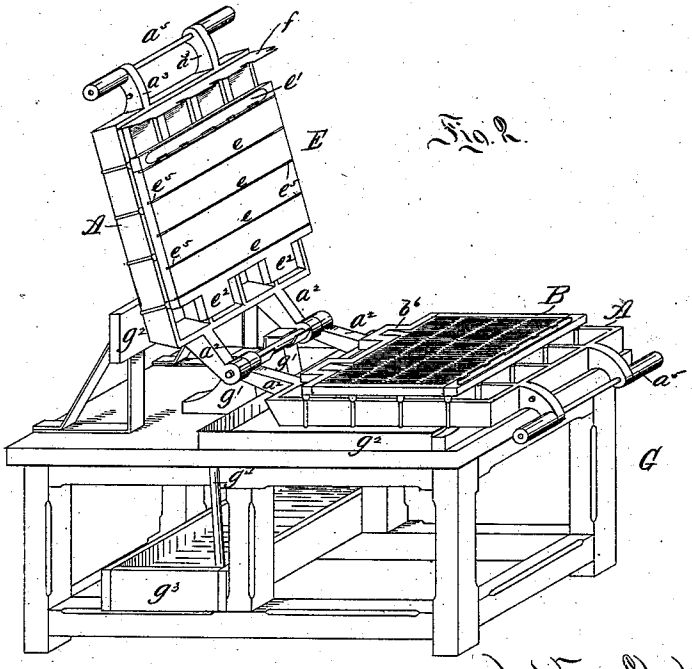


Fig. 2.



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C. F. BRUSH.

MOLD FOR CASTING METALS.

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Fig. 3.

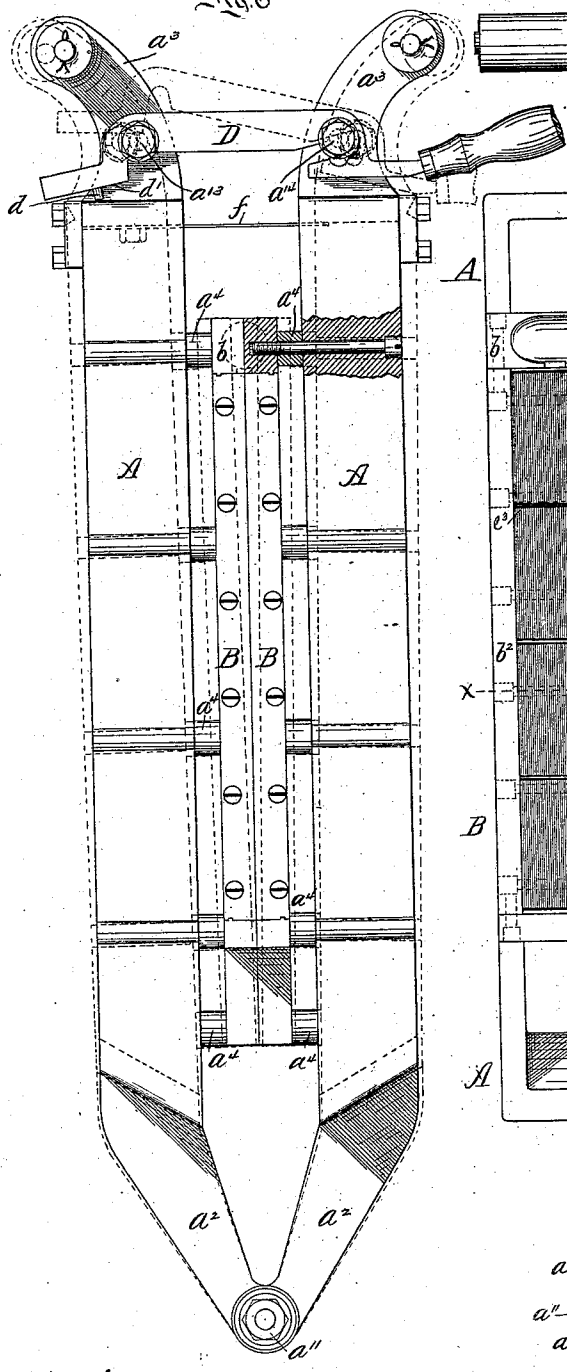
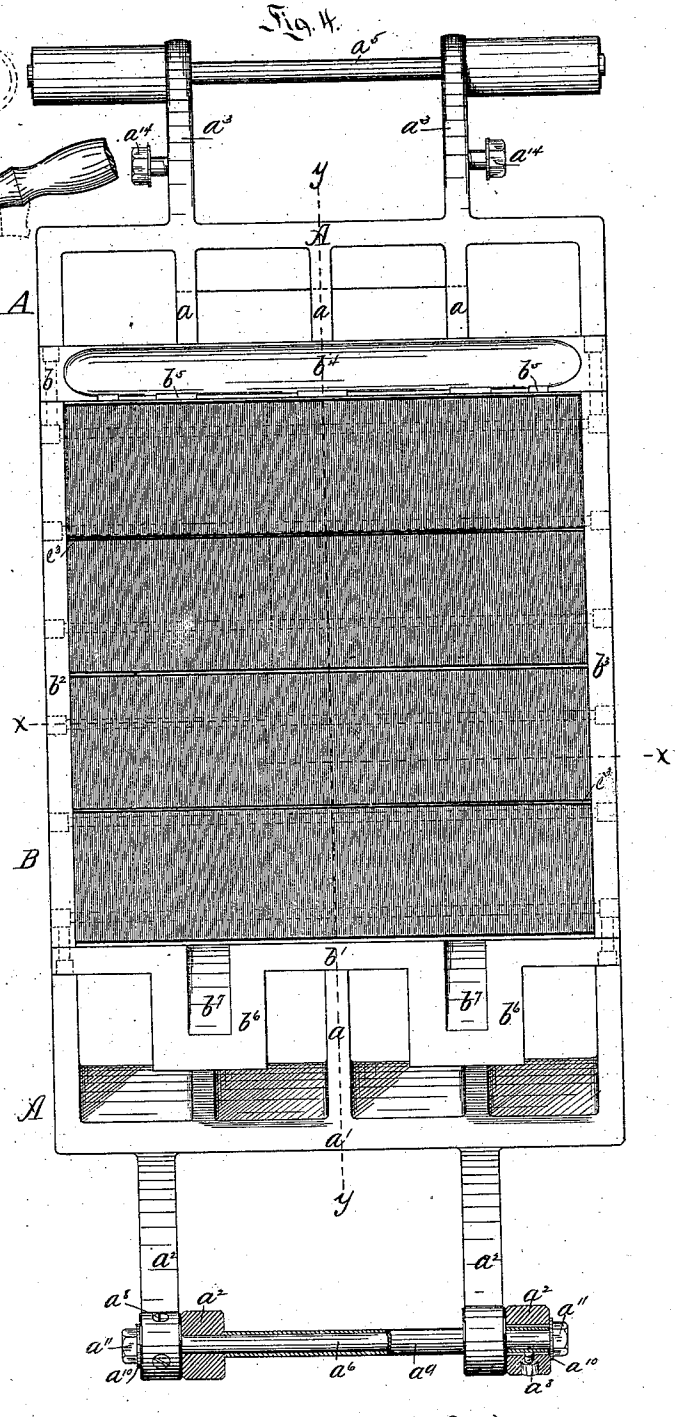


Fig. 4.



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Fig. 5.

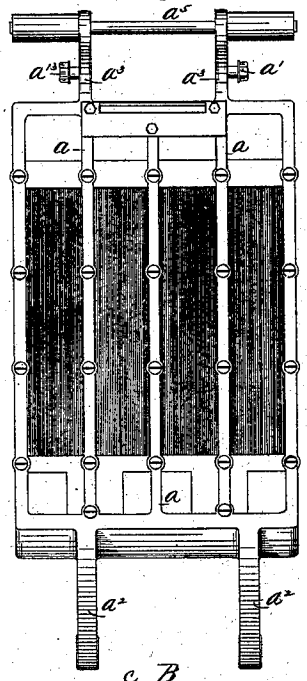


Fig. 12.

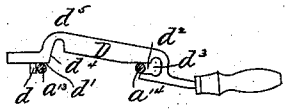


Fig. 13.

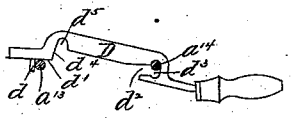


Fig. 14.

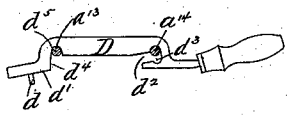


Fig. 10.



Fig. 11.

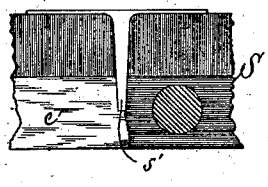


Fig. 6.

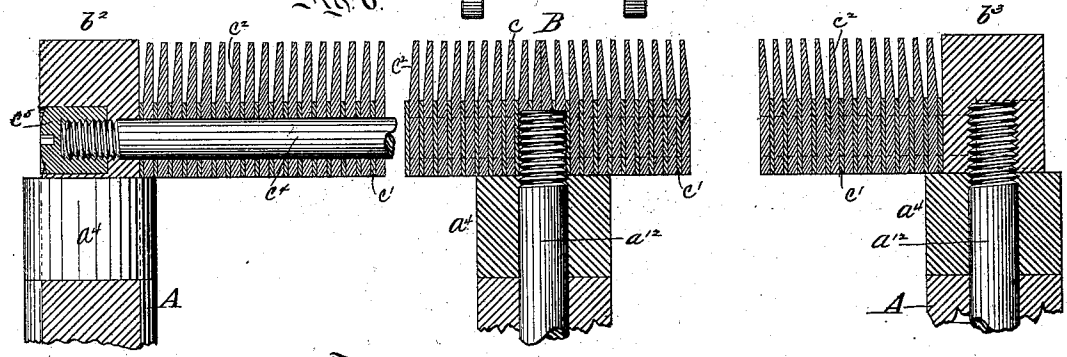


Fig. 7.

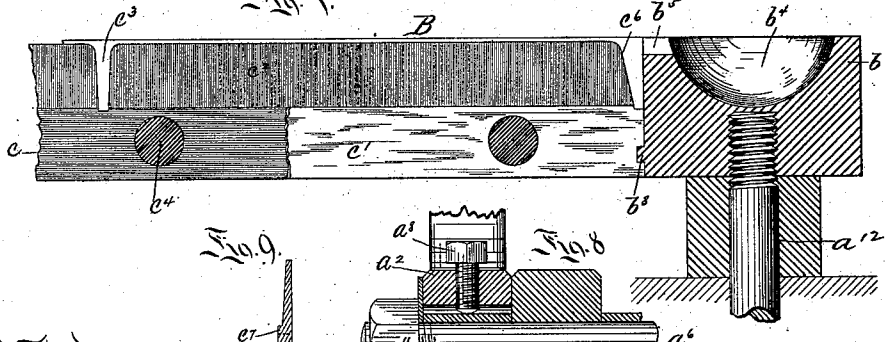
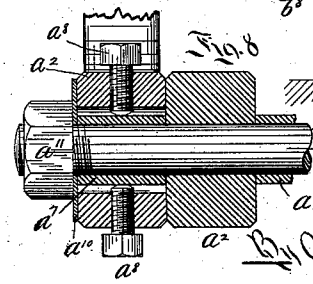


Fig. 9.

Fig. 8.



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UNITED STATES PATENT OFFICE.

CHARLES F. BRUSH, OF CLEVELAND, OHIO.

MOLD FOR CASTING METALS.

SPECIFICATION forming part of Letters Patent No. 293,710, dated February 19, 1884.

Application filed October 24, 1883. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. BRUSH, a citizen of the United States, residing at Cleveland, county of Cuyahoga, State of Ohio, have invented or discovered a new and useful Improvement in Molds for Casting Metals; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a perspective view of my double mold for casting plates with leaves or projections on each side thereof, the mold being shown open and resting on its stand. Fig. 2, Sheet 1, is a similar view of a mold for casting single plates—*i. e.*, plates having leaves or projections on one side only. Fig. 3, Sheet 2, is an edge view to an enlarged scale of my mold, it being represented as closed by full lines and slightly opened by broken lines, for the purpose of illustrating the locking device. Fig. 4, Sheet 2, is a side elevation of one-half of my mold on the same scale as Fig. 3, showing the inner face of the mold on the same scale as Fig. 3. Fig. 5, Sheet 3, is a side elevation of one-half of my mold, the scale being somewhat reduced, showing the outside thereof. Fig. 6, Sheet 3, is a detached view on a still more enlarged scale, showing in section portions of the mold shown in Fig. 4, the section being taken on the line *x x*, Fig. 4. Fig. 7, Sheet 3, is a longitudinal section on the line *y y*, Fig. 4, of the mold proper, the end bar, having therein a part of the filling-head, being shown in section. Fig. 8, Sheet 3, is a sectional view of one of the hinges. Fig. 9, Sheet 3, is a sectional view, showing a modified form of one of the strips. Fig. 10 is a longitudinal section of one of the halves of the mold for casting single plates. Fig. 11 is an inverted sectional view similar to that of Fig. 7, showing a modification of the transverse grooves. Figs. 12 to 14 are diagrammatic views, illustrating the operation of the locking-bar.

My invention relates to a mold for executing the process of casting by the submergence of a jointed or divided mold in a bath of molten metal, separating the parts of the mold and allowing the metal to flow freely therein, and then closing the mold still submerged, as is fully set forth in a separate application, whereby the difficulties heretofore encountered in producing castings having their leaves or projections on one or both sides are practically obviated; and my invention consists, in general terms, in the construction and combination of the parts of such a mold and devices appertaining thereto, all as hereinafter more fully described and claimed.

The flask is composed of two parts, each part consisting of the frame or mold carrier and the mold proper. The frame or carrier A is a rectangularly-shaped casting, and is braced or strengthened by three or more longitudinal bars, *a*, (see Fig. 5,) cast in one piece with the frame. The lower transverse bar, *a'*, of the frame is sloped downward from the outside of the carrier, so as to enter the molten metal with a wedge-like action, and thereby avoid, to a great extent, any splashing of the molten metal when the flask is suddenly plunged therein. On this lower transverse bar are cast two projecting arms or lugs, a^2, which form the continuations of the wedge-like bar *a'*. In the lower ends of these bars are arranged the hinges, to be hereinafter described, by which the two parts of the flask are hinged together. On the upper cross-bar of the carrier are cast two curved arms or lugs, a^3, through which passes the handle a^5, by which the flask is manipulated. At intervals along the inside of each of the longitudinal bars of the carrier A are formed short bosses or projections a^4, and on these bosses rests the mold proper, which is held in place by bolts a^{12}, (see Fig. 6,) passing through the longitudinal bars and the bosses therein, and screwing into the back of the mold proper. These bosses keep the mold B away from the carrier A and allow a free access of the molten metal to all parts of the flask, thereby insuring an equal expansion of all the parts, and preventing to a great extent any warping and twisting of any of the parts.

One-half of the mold proper, B, consists of an outside frame whose inner edges form the outer walls of the matrix, and a series of longitudinal steel strips properly spaced or separated, forming the matrix itself. The outside

frame is made in four pieces, b b' b^2 b^3, the bars b and b', Fig. 4, forming the top and bottom and bars b^2 and b^3 the sides of the mold. The upper bar, b, is recessed longitudinally at b^4 on the inner surface to form one-half of a filling-head, and this recess is connected with the matrix of the mold by slots b^5, (more fully shown in Fig. 7.) Thus provision is made to supply the loss arising from shrinkage during the solidification of the casting. The lower cross-bar, b', has formed thereon two projecting lugs, b^6, which are recessed at b^7 on their inner surfaces, said recesses opening at their inner ends into the matrix. In these recesses are formed lugs on the cast plates, by which they can be carried, or to which handles or other devices may be attached.

The matrix or inner part of the mold is made up of a large number of steel strips, c, arranged longitudinally within the frame. The steel strips c are beveled off at c^2 on one side for about half their width, to give the draft necessary for withdrawal of the leaves of the casting from between the strips c. The bevel c^2 on the strips is formed by grinding, and the grinding should be effected with the strips lying in a plane parallel to the axis of the grinding-wheel, so that the minute grooves indicated by fine lines on the beveled surface in Fig. 7, which are inevitably produced in any grinding operation, will be transverse to the length of the strips, and will lie in planes parallel to the direction in which the casting is withdrawn; consequently the metal which will flow into these grooves in casting will not present any hinderance to the easy withdrawal of the casting, as would be the case were these grooves formed longitudinally in the beveled portions of the strips. These strips c are separated or held apart to form spaces or grooves between them, into which the molten metal can flow by brass strips c', having a thickness corresponding to the thickness of the leaves to be cast, and a width equal to the unbeveled portion of the steel strips c. In place of using the brass strips c' for separating the strips c and forming the bottom of the spaces between them, these strips c may be made thicker, and the upper part thereof, on one side, be so cut or ground away as to form a shoulder, c^7, (see Fig. 9,) the bevel c^2 being formed above said shoulder, as clearly shown. To brace, if need be, the leaves of the casting formed in the spaces between the strips, the strips c are notched, as at c^3, at equal intervals along their length. These notches c^3 are V-shaped and of a width greater than the distance between two adjoining strips, c, and form, when the strips are put in position to form the matrix, a continuous groove across the mold. (See Fig. 4.) The ends of the strips c are also beveled off at c^5 for about one-half of their width, and form, in connection with the end bars, b and b', a channel at each end of the mold, along which the metal can flow. The upper one of these channels is connected with the recess b^4, forming part of the filling-head, by the notches b^5, and thus form a passage along which the metal in the filling-head can flow to the upper ends of each one of the spaces between the strips c; and, further, these channels at each end of the mold form a transverse leaf at each end of the completed casting, of considerable thickness, which brace the longitudinal leaves at their ends and protect them from accidental injury.

Through the body or unbeveled portion of the strips c, through the brass strips c', and through the side bars, b^2 and b^3, are bored holes, through which pass rods c^4, threaded at their ends, and on these rods are screwed the cap-nuts c^5, fitting into the enlarged portion of the holes in the side bars. These nuts force and hold the strips and side bars firmly together, thus forming what is practically a solid plate of metal, having formed on one side thereof a series of narrow longitudinal grooves tapering from the top to the bottom, and also two, three, or more wider transverse grooves similarly tapered. The end bars, b and b', are secured to the parts above described by screws passing through their ends into the side bars, b^2 and b^3, as indicated by dotted lines in Fig. 4. The steel strips c are arranged together with their beveled sides facing outward from the center toward both sides, the flat sides of the two central strips being placed together, as shown in Fig. 6, so that, as the contraction of the metal in cooling is always from the outside toward the center, the leaves of the casting between the strips will be drawn away from the straight side of one strip toward the beveled side of the next strip toward the center by the contraction of the web portion of the casting, thus facilitating the easy withdrawal of the casting from the mold. The ends of the steel and brass strips c and c' and the side bars, b^2 and b^3, are notched, near the lower edge thereof, to receive a tongue or rib, b^8, Fig. 7, on the inside edges of the top and bottom bars, b and b', thus forming a lock to keep the parts in position and support the ends of the steel and brass strips c and c'.

The half of the mold thus far described is used in casting both the double plates, (see Fig. 1,) and the single plates. (See Fig. 2.)

In casting double plates, or plates having leaves or projections on both sides thereof, I employ as the other half of the mold a half-mold, S, nearly similar to the half-mold B in its construction. The differences are as follows: The lugs s are not recessed, but are plain, serving simply as covers for the recesses b^7 in the lugs b^6 of the half-mold B, the whole of the handle or lug of the casting being formed in the recess b^7; and to provide ribs or fins to which can be attached some device for extracting the casting from the mold B, the transverse leaves in this half of the casting projecting upwardly, and which would in such case correspond with the leaves formed

in the notches c^3, are now projected upward to a greater height, so that such added projection may be utilized as a means for taking hold of the casting and lifting it out by suitable grippers, as described in a separate application. The construction by which this greater height of projecting leaf is secured is represented by an inverted section of a portion of the upper half, S, of the mold in Fig. 11, where s' shows a suitable depth of notch or recess transversely across the steel strips, said notch extending also into the brass separating-strips, for the making of fins on the upper side of the casting enough higher than those on the lower side to provide for the gripping and lifting function referred to. There will, therefore, be formed in this upper half, S, of the mold a casting having a series of longitudinal leaves and a series of transverse bracing-leaves; but these latter will extend above the longitudinal leaves in the shape of ribs or fins, which will serve as parts to which the gripping and lifting device can be attached. These deepened grooves or notches s' may be formed in both halves of the mold; but it is not necessary, as by lubricating that half of the mold having the deepened grooves or notches a little more freely than the other half the casting will, on opening the mold, draw from the half S and adhere with greater tenacity to the other half, B, of the mold.

I will next describe the construction of the other half, E, Fig. 2, used in casting single plates—*i. e.*, plates with leaves or projections on one side only. This second half, E, consists of a smooth flat plate of metal having the same shape and size as the mold B, but having cut transversely across its face a series of grooves, *e*, preferably corresponding in size and location to the grooves formed in the mold B by the notches c^3 in the strips *c*. In these grooves *e* are formed fins or ribs on the back of the plate, by which the plate can be drawn from the mold B, the gripping and lifting device above referred to being attached thereto for this purpose. These fins or ribs are to be cut off after having served their intended purpose. A recess, e', corresponding in location and size to the recess b^4 of the other half-mold, is also formed in this plate E, and connected with the upper groove, *e*, by notches e^4, (see Figs. 2 and 10,) the two recesses e' and b^4, when closed, forming the complete filling-head. The lugs e^2 are not recessed, but are plain, performing the same function as the lugs *s* of the half S. Both the half-molds S and E are secured to a carrier-frame similar to the frame A in its form and construction, in the same manner as the half-mold B. These carrier-frames are hinged together at their lower ends by any suitable hinge formed in or attached to the lugs a^2; but I prefer the form of hinge which I will now describe, reference being had to Figs. 4 and 8 of the drawings.

As some of the parts of the flask are larger than others, and consequently will expand more when the mold is heated, provision must be made to compensate for this unequal expansion, and so insure a perfect fitting of the two parts of the mold when closed in the molten metal, and to this end one of the arms or lugs a^2 on each carrier A is bored out to just receive the pintle a^6. The other arm of each carrier is bored to receive and allow considerable play to a sleeve, a^7, Fig. 8, which will fit closely around the pintle a^6. This sleeve is held and adjusted within the opening in the arm a^2 by set-screws a^8. As the parts of the hinge should be drawn so closely together as to prevent any metal from flowing into the parts of the hinge, I brace them against any inward flexure by placing a piece of pipe, a^9, Figs. 4 and 8, through which the pintle a^6 can pass, between the two inside arms of the hinge. As this piece of pipe is of a size equal to the normal distance between the two inside arms, a^2, the parts of the hinge can be tightly drawn together without any danger of breaking or bending the arms. The outside parts of the hinge are protected by a washer, a^{10}, Fig. 8, held in place by the nut a^{11} on the end of the pintle.

To prevent the metal from spurting up when the two parts of the flask are suddenly brought together in the molten metal, a guard, *f*, of sheet metal, is attached to the upper cross-bar of one of the carriers, and is provided with notches, into which fit the bars *a* of the other half of the carrier. The web or plate on which the thin leaves or projections are formed in casting is formed by making the outside bars *b*, *b'*, b^2, and b^3 slightly higher than the top edges of the strips *c;* but this increase in elevation of the outside bars may be very slight, and, in fact, may be wholly omitted, as there will always, in the use of this mold, be a small amount of metal caught between the perimeters of the two molds when they are closed in the molten bath; consequently, as the two molds never come into absolute contact when in use, a web will be formed inside of the mold. This metal so caught between the two parts of the mold is prevented from escaping from the slight opening between them by the sudden cooling of the metal caught between the edges of the mold, as above described, the chilled metal acting as a dam or packing to prevent the metal inside of the mold from escaping, as more particularly set forth in a separate application.

As stated in the application last referred to, the mold is opened and closed while in the molten metal and immediately withdrawn therefrom; therefore, to hold the parts of the flask closed while being withdrawn and until the metal is set, wrist-pins a^{13} and a^{14} (see Figs. 3 and 12, are attached to each of the arms a^3. On these pins, on each side of the handles, I place the locking-bar D just before the mold which is tightly closed and swung from the handles a^5, is dipped into the bath. This bar is so placed (see Fig. 12) that

the pin d rests against one of the wrist-pins a^{13}, the flat portion d' of the bar D resting on the same pin, the pin a^{14} on the other handle resting at the same time in the straight slot d^2 at the other end of the locking-bar. The flask is now immersed in the bath, and is then opened, which opening may be effected by allowing the two halves of the mold to swing from each other by gravity when their lower pivoting-point strikes the bottom of the bath-tank, or by hand; or they may be forced apart by suitable mechanism provided for the purpose, as set forth in a separate application for mechanism for manipulating the molds. This opening movement of the parts of the flask draws one of the pins a^{14} into the curved slot d^3, and this end of the locking-bar drops until the pin a^{14} lies in the upper part of the curved slot d^3, Fig. 13, the pin a^{13} having been pressed by the same movement of the parts of the flask against the pin d on the locking-bar D. Now, the closing of the parts of the flask causes the pin a^{14} to push against the sides of the curved slot d^3, holding the locking-bar stationary, while the pin a^{13} slides inward along the flat part d' until it reaches the vertical part d^4, when this end of the locking-bar drops down, the pin a^{13} entering the recess d^5. (See Fig. 14.) The vertical part d^4 and the outer wall of the recess d^5 preferably form an arc of a circle whose radius is equal to the distance between the outside of the pins a^{13} and a^{14}, and whose center is located a little below the slot d^3, so that as the outer end of the locking-bar drops down the pins are drawn slightly toward each other by the part d^4 and the outer wall of the recess d^5 with a wedging action. It will be observed that this locking-bar, in connection with the pins on the handles, not only serves as a lock, but also prevents too great a separation of the parts of the mold when in the molten metal.

In Figs. 1 and 2 the flasks containing double and single molds are shown open and resting on a stand, G, on which the flasks are deposited on being taken from the metal bath. The flask is closed when lifted from the molten metal, and is deposited on a stand, G, the pintle of the hinge being placed in the hook g, secured to the posts g'. The flask is then allowed to lean against the support g^2. Next, one part of the flask is drawn away from the other and is laid down on the top of the stand. This part of the flask should be that one to which the casting adheres when the flask is opened, so the casting may be more easily seized and drawn from the mold. After the casting is withdrawn, the flask is cooled down to the proper temperature, water being applied with a sponge for that purpose. For catching the water which flows off the mold during the cooling operation, a pan, g^2, is placed on the stand, and the half-flask lies in said pan when it is lowered onto the table. I connect the pan g^2 with a waste-basin, g^3, arranged under the stand, by a pipe, g^4. After the mold has been properly cooled, a suitable lubricant is applied, and the mold is again in condition for use.

I do not herein limit myself to a hinge or jointed flask, but consider it within the scope of my invention to so connect the two parts of the flask that they may be moved toward and from each other in a direct line; or they may be so jointed at either side or at the top, in place of being jointed at the bottom, such substitute means for operating flasks being well known in the art.

It is obvious that strips c, instead of being arranged longitudinally, may be arranged transversely, in connection with suitable filling-heads in the surrounding bars, without any substantial departure from the construction above described.

While I have described the locking mechanism with some particularity, I do not wish to be understood as confining myself to the particular construction shown and described, the essential features of the locking-bar being such that when placed upon projecting parts of a closed mold it is moved into a locking position by the opening of the parts of the mold and automatically shifted to a locking position, so as to lock the parts together when the mold is closed; and for this purpose the forms and arrangement of the slots, lugs, &c., may be varied at pleasure, provided the function and mode of operation remain substantially unchanged.

I claim herein as my invention—

1. In a mold for casting metals, the combination of a surrounding frame and a series of spaced strips arranged within said frame, the frame and strips constituting the casting-faces or walls of the mold, substantially as set forth.

2. In a mold for casting metals, the combination of surrounding frame and series of properly-spaced strips arranged longitudinally within said frame, each strip being notched at one or more points, as at c^3, along its face edge, substantially as set forth.

3. In a mold for casting metals, the combination of a surrounding frame and a series of transversely-beveled strips arranged within said frame, the frame and strips constituting the casting faces or walls of the mold, substantially as set forth.

4. In a mold for casting metals, the combination of a surrounding frame, a series of transversely beveled and notched strips arranged within said frame, and a series of narrow strips arranged between and separating the other strips, substantially as set forth.

5. In a mold for casting metals, the combination of a surrounding frame consisting of top, bottom, and side bars, the top bar being provided with a longitudinal filling-head recess and slots connecting said recess with the matrix of the mold, a series of transversely beveled and notched strips arranged within the frame, and a series of narrow spacing-strips, substantially as set forth.

6. In a mold for casting metals, the combination of a surrounding frame consisting of top, bottom, and side bars, the top bar having a longitudinal recess and slots connecting said recess with the upper transverse groove in the matrix, and the lower bar having recessed lugs connecting with the lower transverse groove of the matrix, a series of strips being transversely beveled on their sides and ends, and a series of narrow spacing-strips, substantially as set forth.

7. A mold for casting metals, consisting of two parts hinged or jointed together, as described, each of said parts having a series of transverse and longitudinal grooves formed in its surface, the transverse grooves in one part being somewhat deeper than the like grooves in the other part, substantially as set forth.

8. A mold for casting metals, consisting of two parts hinged or jointed together, as described, one of said parts having a series of transverse and longitudinal grooves in its surface, and the other part having transverse grooves, substantially as set forth.

9. A mold-structure the casting-faces of which are composed wholly or in part of parallel or approximately parallel strips having beveled sides, said strips being arranged with their beveled sides facing in opposite and outward directions, substantially as set forth.

10. The combination of the two parts of a flask, each part being provided with two perforated lugs, one of said lugs on each part having an adjustable sleeve within its perforations, and a pintle, substantially as shown and described.

11. The combination of the two parts of a flask, each part being provided with two perforated lugs, one of said lugs on each part having an adjustable sleeve within its perforations, a pintle passing through the perforations and sleeves of the lugs of each part, and a pipe extending between the inside lugs and surrounding the pintle, substantially as shown and described.

12. The combination of the two parts of a flask, having arms with pins thereon, a locking-bar, D, having at one end the pin d, the plain portion d', the vertical part d^4, and recess d^5, and at the other end the horizontal slot d^2 and the vertical and curved slot d^3, said parts being constructed and arranged substantially as shown and described.

13. In combination with the two parts of a divided mold, a locking mechanism suitably constructed to permit of the opening of the mold, and thereby be shifted to a locking position, and to automatically lock the mold in a closed position on the closing thereof, substantially as set forth.

14. In combination with the two parts of a divided mold, a locking mechanism suitably constructed to permit of the opening of the mold, and thereby be shifted to a locking position to limit the opening movement, and to automatically lock the mold in a closed position immediately on the closing thereof, substantially as set forth.

In testimony whereof I have hereunto set my hand.

CHARLES F. BRUSH.

Witnesses:
JNO. CROWELL,
CHAS. H. DORER.