Dec. 11, 1934. E. M. CHANDLER 1,983,578

METAL TRANSFER

Filed Dec. 3, 1932

Fig. 1.

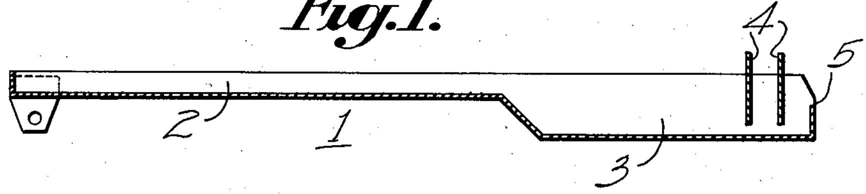


Fig. 2.

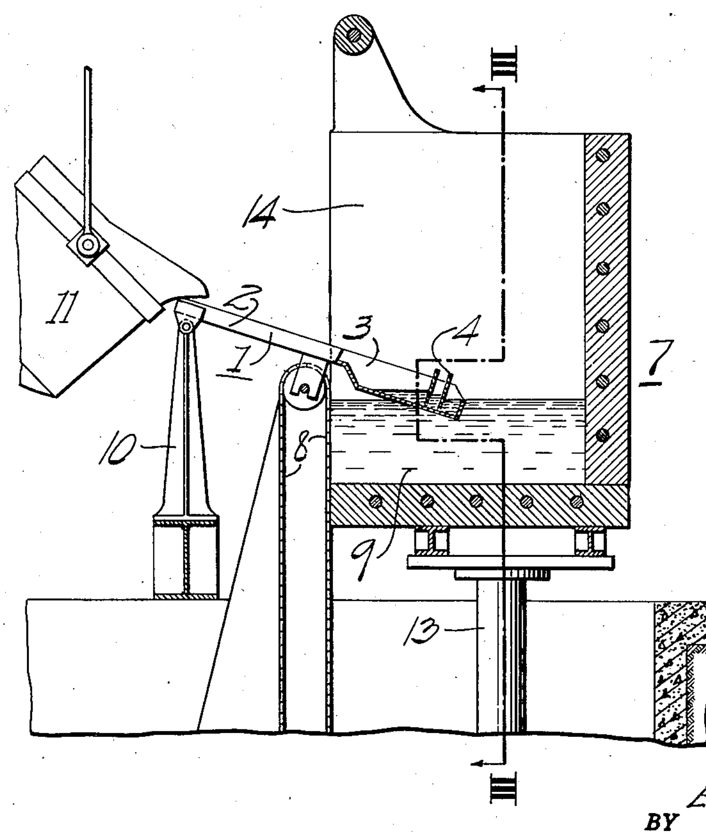
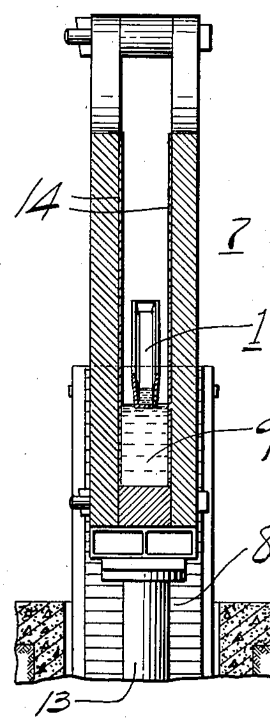


Fig. 3.



INVENTOR
EDWARD M. CHANDLER
BY
[signature]
ATTORNEY

Patented Dec. 11, 1934 1,983,578

UNITED STATES PATENT OFFICE

1,983,578

METAL TRANSFER

Edward M. Chandler, Alcoa, Tenn., assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania

Application December 3, 1932, Serial No. 645,507

8 Claims. (Cl. 22—209)

This invention relates to the transfer of molten metal. It relates especially to the quiet transfer of molten metal from one container to another such as from a crucible to a mold, for example, and the simultaneous removal of dross from the metal.

In casting metals, it is always desirable that the amount of metal oxide or dross introduced into the mold with the metal be kept at a minimum. This is especially true in the casting of ingots for rolling, as dross inclusions in such ingots cause defects in the rolled sheets. In casting ingots of the more easily oxidized metals, such as aluminum, for example, special means must, therefore, usually be provided for skimming or otherwise removing dross from the metal after, or preferably during, the casting or pouring operation. With metals of this type, it is also usually necessary to take precautions against excessive oxidation or dross formation which may take place during the casting operation by the entrapment of air or the entrainment of surface oxide film due to cascading the metal poured or otherwise causing a violent turbulence.

When casting in a mold of the open side type the difficulties of securing a sound ingot are greatly magnified, especially when casting ingots of the duplex type having plates of dissimilar metal cohesively attached to their sides during the casting operation. This is a known type of mold, being described in U. S. Patent 1,734,786 to Züblin, for example, and differs from the ordinary top-pour ingot mold in that one side is opened before casting and is progressively closed during the pouring operation by means of a flexible side wall which is pressed against a faced portion of the mold to make a metal-tight seal. In the casting of an ingot of the type mentioned above, plates of aluminum or alloys thereof are placed on opposite sides of the mold in close contact with the walls and molten aluminum or aluminum alloy is poured in the space between, preferably from a central point. The metal cast should be at a temperature at which it will cohesively adhere to the plates after cooling, but should not have such a high temperature or such a violent motion as to melt or vary the thickness of the side plates.

In the past, difficulty has been experienced in securing uniformly sound ingots of this type for several reasons. It is absolutely necessary that the side plates remain intact during the pouring operation. It is also of prime importance that no dross be entrapped with the metal poured or on the surface of the finished ingot. There should not be any violent stream or current in the mold during casting. The metal should be poured from a central point to secure a balanced distribution of heat, but it has been the custom to pour the metal against the side wall of the mold opposite its point of entrance, usually from a trough extending across the mold, to avoid formation of dross due to the turbulence of a free stream. This method had the disadvantage that the metal was somewhat cooled after it had flowed to the opposite side of the mold, and the side against which the trough discharged was apt to become too warm for the aluminum side plate to remain intact at the point of contact therewith. In order not to carry dross from the crucible into the mold the trough had to be placed at an angle of 10 degrees or less from horizontal. This limited the minimum size of mold which could be poured by this method without raising the discharge end of the trough too far above the surface of the metal. For general application this method has therefore been found unsatisfactory.

The primary object of my invention is to provide a method of overcoming the difficulties hereinabove described. A second object is to provide an improved molten metal transfer device which is adapted to deliver a quiet stream of metal and in addition is capable of skimming the dross from the said stream during the transfer. A further object of my invention is to provide a metal transfer device capable of great flexibility in use, both as to the angle of inclination and the relative speed of the transfer. A specific object of my invention is to provide a metal transfer device adapted for use in pouring an ingot mold of the open side type, and particularly in casting ingots of the duplex type. These and other objects and advantages will be more readily understood and appreciated from the following description taken in conjunction with the drawing, in which;

Fig. 1 is a vertical sectional view of my improved transfer device;

Fig. 2 is a somewhat diagrammatic vertical sectional view with parts in elevation, of a casting assembly comprising a transfer device in operative position in a mold of the open side type; and

Fig. 3 is a vertical sectional view on the line III—III in Fig. 2.

Referring to Fig. 1, the preferred form of my transfer device, which is generally designated by the numeral 1, consists essentially of a trough portion 2 to which is rigidly attached the deepened reservoir portion 3. In the reservoir one or more baffle plates 4 are inserted. The baffles fit the sides of the reservoir closely, so that metal flowing through the reservoir must pass between the bottom of the reservoir and the lower edge of the baffle or baffles. A weir 5 is formed in the discharge end of the reservoir. The elevation of the mouth of the weir above the bottom of the reservoir is always greater than the elevation of the lower edge of the baffle 4, but preferably lower than the bottom of the trough 2. This arrangement is an essential feature of my invention, as it keeps the lower edge of the baffle plate beneath the surface of the metal substantially throughout the pouring operation and thus insures the skimming of the dross from the metal passing thereunder. The baffles and the weir, in cooperation with the enlarged reservoir, also tend to retard the velocity and diffuse the force of the stream, which is frequently of importance.

In the construction of this device strength and simplicity are important features. The device is usually made of metal throughout. If protection is needed to avoid attack or solution by the metal transferred, the device may be given a lime wash or other similar coating, or the surfaces may be covered with graphite. In large sizes it may be more convenient to form the reservoir and the trough separately and join them either by welding or by a detachable joint. The baffle plates 4 are usually shaped to wedge between the walls of the reservoir but may be mounted between guides or held in place by any other convenient means.

While my invention is broadly useful in the field of metal founding, and I do not intend that its application should be limited to any particular example, I have chosen to describe its operation in a casting process which is eminently well adapted to bring out its essential and desirable features. The process chosen for example is the casting of aluminum alloy ingots of the duplex type, such as are prepared for rolling into a sheet product, consisting of a strong aluminum alloy center protected on each side by a coating of pure aluminum or an alloy thereof. Ingots of this type are often cast in an open side mold, as stated hereinabove. My invention overcomes the difficulties previously encountered in casting ingots of this type and provides means for quietly delivering dross-free metal to the center of a mold, or to substantially any other desired point in the mold, with a wide flexibility in the angle of the inclination of the trough to the surface of the metal. By my invention the maximum angle of inclination has been increased from about 10 degrees, the previous maximum, to 45 degrees or more from horizontal.

The casting assembly shown in Figs. 2 and 3 consists of an "open side" mold 7 with a flexible side or side-wall 8, which preferably takes the form of an endless belt as shown, and which closes the mold and retains therein a quantity of molten metal 9. The transfer device 1 described hereinabove extends over the flexible side 8 of the mold with the weir 5 and the lower edge of the baffle 4 submerged in the metal 9 contained therein. This device may be pivotally mounted on a support 10 extending upwardly from the floor, or may be suspended from a crane or the like, or otherwise supported. Molten metal is delivered to the transfer device from a crucible 11 or other container. The mold 7 is preferably mounted on a hydraulic piston 13 or other suitable means for raising and lowering the mold as desired. The flexible side 8 is kept tightly in contact with the open side of the mold by spring-mounted rollers or the like (not shown) pressing against the back wall of the mold.

When preparing to pour an ingot of the above-described duplex type by means of my improved method and apparatus, the mold 7 is raised on the piston 13, or the flexible side 8 is relatively lowered by other means, until the top of the flexible side is substantially level with the bottom of the mold. An aluminum or aluminum alloy plate 14 of correct size and predetermined thickness is placed firmly against each side wall of the mold. The transfer device 1 is then positioned so that the reservoir 3 rests on the bottom of the mold, preferably near the center thereof. The trough and reservoir may have any desired angle of inclination from the horizontal, up to about 45 degrees. The molten metal is poured from the crucible 11 into the trough 2, by which it is conducted into and fills the reservoir 3, thus submerging the lower edge of the baffle plates 4. When the reservoir is filled, metal discharges over the weir 5 into the mold. When the level of the metal in the mold rises somewhat above the weir, the transfer device is raised, or preferably the mold is lowered, so as to keep the lower edge of the baffle a small distance under the surface of the metal. The flexible side of the mold is also, of course, progressively raised as the metal rises in the mold. This progressive raising of the transfer device and the flexible side wall relative to the bottom of the mold continues until the mold is filled to the desired extent.

During the flow of the metal through the reservoir and beneath the baffle or baffles dross is skimmed therefrom and arrested by the baffles. The velocity of the stream is also largely reduced by the action of the baffle and the weir discharging beneath the surface of the body of molten metal in the reservoir and mold. Therefore, it has been found in practice that much less skill in pouring is necessary to secure sound ingots by this method. Further, it has been found that the rate of pouring can be varied over a wide range without danger of damaging the side plates 14 or encountering any other difficulties, and that the limiting angle of inclination of the trough is materially increased, as stated hereinabove.

It will be obvious to those skilled in the art of metal founding that my invention may be embodied and applied in forms differing from those described by way of example hereinabove without departing from the spirit of my invention and the scope of the appended claims.

I claim as my invention:

1. Apparatus for transferring molten metal, comprising a trough opening at one end into a reservoir of greater depth than said trough, said reservoir being provided with a transverse downwardly-extending baffle terminating below the level of the bottom of said trough, and having in the end thereof a weir extending upwardly above the lower edge of said baffle.

2. Apparatus for transferring molten metal, comprising a trough closed at one end and opening at the other end into an integral reservoir of greater depth than said trough and of substantially the same width, said reservoir being provided with a transverse downwardly-extending baffle terminating below the level of the bottom of said trough, and having in the end thereof a weir extending upwardly above the bottom of said baffle but terminating below the level of the bottom of said trough.

3. Transfer apparatus for delivering molten metal to a receiver therefor, comprising an in-

clined trough with an enlarged reservoir at one end thereof, a baffle extending downwardly into the reservoir, and a weir at the end of said reservoir, said weir and the lower edge of said baffle being beneath the surface of the molten metal contained in said receiver.

4. Transfer apparatus for delivering molten metal to a receiver therefor, comprising a trough inclined toward the surface of metal in the receiver and having its lower end inserted therein, and a baffle extending downwardly into said trough adjacent said lower end thereof, the lower edge of said baffle being beneath the surface of the metal.

5. The process of casting metal in a mold of the open side type having a flexible wall, which comprises flowing molten metal down an inclined path over the flexible wall of the mold, skimming dross from said metal during its flow along said path, retarding the flow of metal, and quietly discharging substantially dross-free metal substantially at the center of said mold.

6. The process of casting metal in a mold of the open side type having a flexible wall, which comprises flowing molten metal down an inclined path extending over the flexible wall of the mold, skimming dross from said metal during its flow through said path, and quietly discharging substantially dross-free metal over a submerged weir into said mold.

7. The process of casting metal, which comprises flowing molten metal down an inclined path under a baffle which skims dross from the metal and over a weir into a mold, and maintaining the lower edge of the baffle beneath the surface of the metal in the mold substantially throughout the casting operation.

8. The process of casting duplex metal ingots in a mold of the open side type having a flexible wall, which comprises placing metal plates against opposite closed sides of said mold, flowing molten metal down an inclined path over the said flexible wall, skimming dross from the molten metal during its flow along said path by passing it under a fixed downwardly-extending baffle, and quietly discharging substantially dross-free metal over a submerged weir substantially at the center of the mold.

EDWARD M. CHANDLER.