Sept. 11, 1956 A. WITTMOSER 2,762,096

METAL CASTING APPARATUS

Filed June 24, 1955

2 Sheets-Sheet 1

Fig. 1

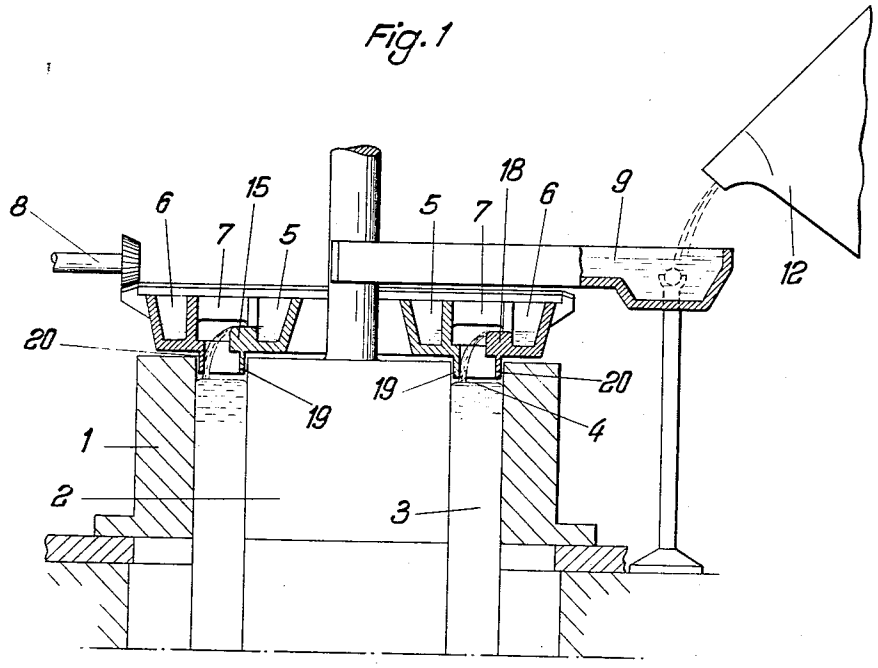

Fig. 2

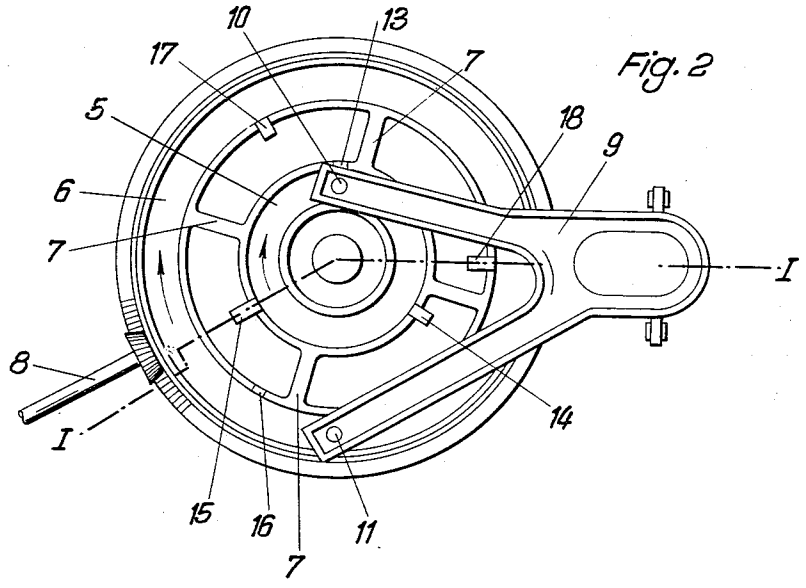

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Fig. 3

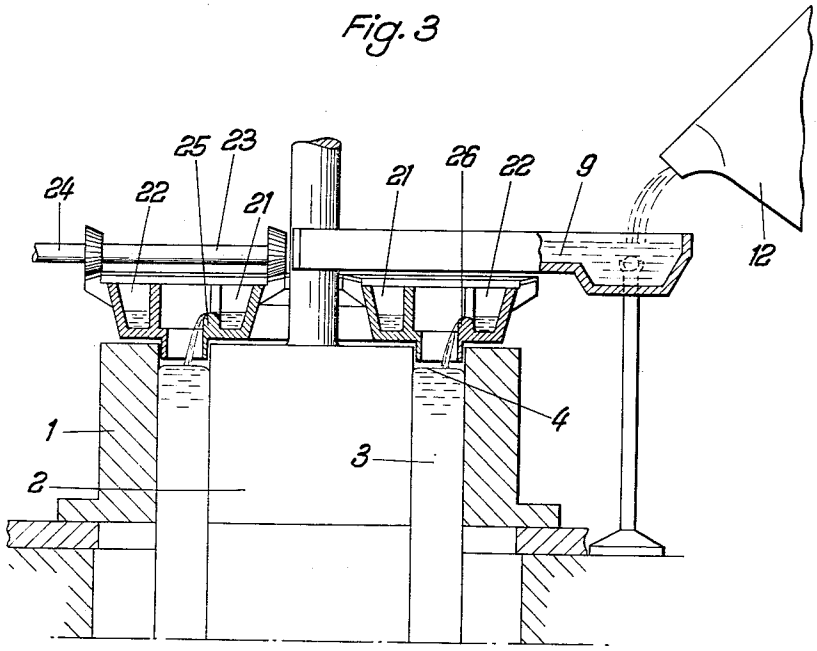
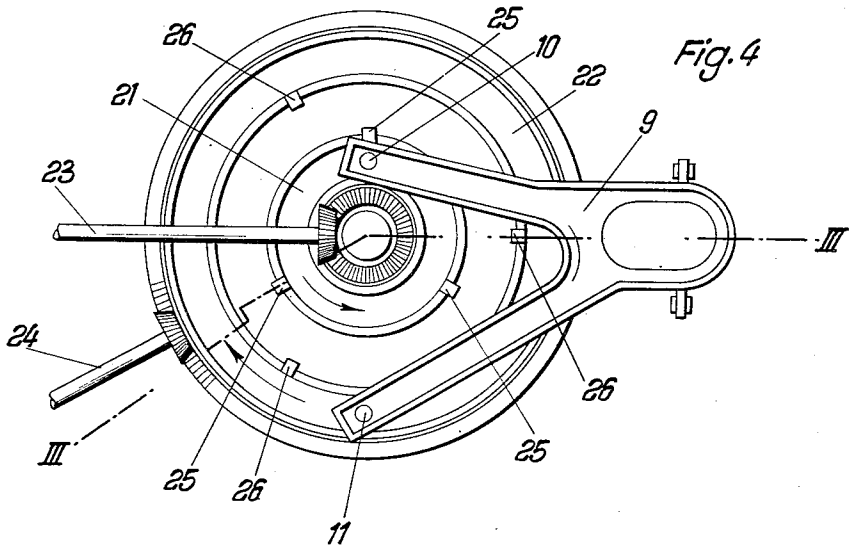


Fig. 4



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METAL CASTING APPARATUS

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14 Claims. (Cl. 22—79)

The present invention relates to metal casting apparatus.

More particularly, the present invention relates to a continuous metal casting apparatus for casting tubes or the like.

There exist metal casting apparatuses for casting tubes or the like having relatively thin walls. However, known apparatuses are incapable of continuously casting tubes or the like having thick walls, inasmuch as the techniques by means of which thin-walled tubes are produced do not lend themselves for casting thick-walled tubes, and when existing apparatuses are called upon to cast thick-walled tubes the molten metal is unevenly distributed within the mold and, when hardened, will form an inferior product.

It is therefore one of the objects of the present invention to provide a metal casting apparatus which is particularly adapted for continuously casting thick-walled tubes or the like.

It is another object of the present invention to provide a continuous casting apparatus for casting tubes or the like, which casting apparatus is capable of pouring molten metal evenly into a mold.

It is yet another object of the present invention to provide a continuous metal casting apparatus which is sturdy, which comprises a minimum number of parts and which may therefore be constructed at low cost.

With the above objects in view the present invention mainly consists in a metal casting apparatus for casting tubes or the like, which apparatus includes mold means defining an upwardly extending annular space having a central axis and inner and outer upper edges and being adapted to receive molten metal. Inner and outer annular molten metal supply means are provided for supplying molten metal to the annular space. These supply means are arranged above the mold means, concentric with the annular space and rotatable about the above-mentioned axis, and the inner supply means has an outer peripheral portion adjacent the inner edge of the annular space and formed with opening means therethrough and the outer supply means has an inner peripheral portion adjacent the outer edge of the annular space and formed with opening means therethrough. Drive means are provided for rotating the inner and outer supply means about the axis either together in the same direction or separately in opposite directions, so that molten metal may be supplied to the annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of the annular space during rotation of the inner and outer supply means about the above-mentioned axis.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is an elevational view, partly in section, of a preferred embodiment according to the present invention taken substantially along line I—I of Fig. 2;

Fig. 2 is a plan view of the embodiment illustrated in Fig. 1;

Fig. 3 is an elevational view, partly in section, of another preferred embodiment according to the present invention taken substantially along line III—III of Fig. 4; and

Fig. 4 is a plan view of the embodiment illustrated in Fig. 3.

Referring now to the drawing and to Figs. 1 and 2 thereof in particular, there is illustrated a preferred embodiment of the present invention of a continuous casting apparatus which includes an outer substantially cylindrical mold member 1 and an inner cylindrical core member 2, which members together constitute a mold means and define between themselves an upwardly extending annular space 3 which is adapted to receive molten metal. A tube or the like may thus be continuously cast in the space 3 by maintaining the annular liquid level 4 of the molten metal substantially at the level indicated in Fig. 1, in a manner well known in the art. If desired, suitable cooling means (not shown) may be provided for cooling the members 1 and 2.

Inner and outer annular molten metal supply troughs 5 and 6 are provided for pouring molten metal into the space 3. The troughs 5 and 6 are connected to each other by a plurality of radial ribs 7, are arranged concentrically with the space 3 and are rotatable about the central axis thereof. The arrangement of the parts is such that the inner trough 5 is arranged above and adjacent to the inner edge of the space 3 and the outer trough 5 is arranged above and adjacent to the outer edge of the space 3, as is clearly shown in the drawing. More particularly, the outer peripheral edge of the inner trough 5 has a diameter approximately equal to the inner diameter of the space 3 and is therefore substantially above inner edge thereof, and the inner peripheral edge of the outer trough 6 has a diameter approximately equal to the outer diameter of the space 3 and is therefore substantially above the outer edge thereof.

Suitable drive means 8 are provided for rotating the troughs 5 and 6, so that both may rotate together about the central axis of the annular space in the direction shown by the arrows in Fig. 2.

A bifurcated supply trough 9 is arranged above the troughs 5 and 6. The free ends of the arms of the trough 9 are provided with bottom openings 10 and 11 which are arranged above the annular troughs 5 and 6, respectively, so that when molten metal is poured into the supply trough 9 by means of a ladle 12, shown fragmentarily in Fig. 1, the metal may flow into the annular troughs 5 and 6.

The outer peripheral side wall portion of the trough 5 is provided with a plurality of inner opening means, three of which are shown at 13, 14 and 15. These opening means may be constituted by slots or bores passing through the inner peripheral side wall and are angularly displaced from each other, as shown in Fig. 2. Preferably, the opening 13 is fashioned so that a stream of molten metal issuing therethrough will impinge upon the liquid level 4 in the region of its inner edge adjacent the core member 2, the opening 14 so that the stream of molten metal issuing therethrough will impinge upon the liquid level 4 in the region of its central annular portion, i. e., approximately midway between the members 1 and 2, and the opening 15 so that the stream of molten metal issuing therethrough will impinge upon

the liquid level 4 in the region of its outer edge adjacent the outer mold member 1.

Similarly, the outer peripheral side wall portion of the trough 6 is provided with a plurality of outer opening means, three of which are shown at 16, 17 and 18. These opening means may be similar to the opening means 13, 14 and 15 and are preferably fashioned so that a stream of molten metal issuing through opening 16 will impinge upon the liquid level 4 in the region of its outer edge, a stream of molten metal issuing through opening 17 will impinge upon the liquid level 4 in the region of its central annular portion, and a stream of molten metal issuing through opening 18 will impinge upon the liquid level 14 in the region of its inner edge. As is clearly shown in Fig. 2, the openings 13, 14, 15 are angularly displaced relative to the openings 16, 17, 18.

Suitable baffle means may be provided for deflecting streams of molten metal issuing through the openings 13 to 18 so as to prevent such streams from impinging directly upon the mold members 1 and 2. The baffle means may take the form of an inner annular baffle member 19 which is mounted on or integral with the inner trough 5 and extends downwardly into the annular space 3, as well as an outer annular baffle member 20 which may be mounted on or integral with the outer trough 6 and which also extends downwardly into the annular space 3. In this way, direct impingement of streams of molten metal onto the mold members 1 and 2 is prevented as may best be seen in Fig. 1.

If desired, the annular baffle members 19 and 20 may be replaced by downwardly extending baffle portions arranged opposite the opening means of the opposite trough, i. e., the annular baffle member 19 may be replaced by three baffle portions which are opposite the outer openings 16, 17 and 18, respectively, and the annular baffle member 20 may be replaced by three baffle portions which are opposite the inner openings 13, 14 and 15, respectively.

Moreover, even the above-described six baffle portions may be replaced by two baffle portions, one on the outer trough 6 and located opposite the inner opening 15 and the other on the inner trough 5 and located opposite the outer opening 18 inasmuch as the streams of molten liquid issuing through these two openings 15 and 18 are particularly likely to impinge directly upon the mold members 1 and 2, respectively, as may readily be seen in Fig. 1.

The operation of the casting apparatus illustrated in Figs. 1 and 2 may readily be understood from the above description. While molten metal is supplied to the troughs 5 and 6, the same are rotated by means of the drive 8 so that a fresh supply of molten metal will be added uniformly throughout the entire annular liquid level of the molten metal in space 3. In this way, a flawless and uniformly cast thick-walled tube or pipe may be obtained.

The embodiment illustrated in Figs. 3 and 4 is similar to that illustrated in Figs. 1 and 2 except that the inner and outer troughs 21 and 22 may be rotated independently of each other about the central axis of the annular space 3. Accordingly, separate drive means 23 and 24 are provided, which drive means are adapted to rotate the troughs 21 and 22 in opposite directions, as indicated by the arrows in Fig. 4.

In the instant embodiment, the outer peripheral side wall portion of the inner trough 21 is provided with similar openings 25 and inner peripheral wall portion of the outer trough 22 is provided with similar openings 26. The openings 25 and 26 are fashioned so that the streams of molten metal issuing therethrough will impinge upon the liquid level 4 approximately midway between the mold members 1 and 2, it being understood, however, that the opening means 25 and 26 may be fashioned so that the several streams of molten metal issuing therethrough will impinge the annular liquid level 4 at different places, i. e., near the inner or outer edges thereof.

Also, the inner and outer baffle members associated with the embodiment shown in Figs. 3 and 4 are preferably annular ones so as to be adapted to prevent any streams of molten metal from impinging directly upon the mold members 1 and 2, irrespective of the relative position of the troughs 21 and 22.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of metal casting apparatuses differing from the types described above.

While the invention has been illustrated and described as embodied in metal casting apparatus for continuously casting tubes or the like, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a metal casting apparatus for casting tubes or the like, in combination, mold means defining an upwardly extending annular space having inner and outer upper edges and adapted to receive molten metal; and inner and outer annular molten metal supply means arranged above said mold means adjacent said inner and outer edges, respectively, of said annular space for supplying molten metal thereto.

2. In a metal casting apparatus for casting tubes or the like, in combination, mold means defining an upwardly extending annular space having a central axis and inner and outer upper edges and being adapted to receive molten metal; and inner and outer annular molten metal supply means arranged above said mold means adjacent said inner and outer edges, respectively, of said annular space for supplying molten metal thereto, said inner and outer supply means being rotatable about said axis.

3. In a metal casting apparatus for casting tubes or the like, in combination, mold means defining an upwardly extending annular space adapted to receive molten metal; and inner and outer annular molten metal supply means arranged above said mold means for supplying molten metal to said annular space, said inner and outer supply means being concentric with said annular space, the outer diameter of said inner supply means being approximately equal to the inner diameter of said annular space and the inner diameter of said outer supply means being approximately equal to the outer diameter of said annular space whereby molten metal may be supplied to said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space.

4. In a metal casting apparatus for casting tubes or the like, in combination, mold means defining an upwardly extending annular space having a central axis and adapted to receive molten metal; and inner and outer annular molten metal supply means arranged above said mold means for supplying molten metal to said annular space, said inner and outer supply means being concentric with said annular space and rotatable about said axis, the outer diameter of said inner supply means being approximately equal to the inner diameter of said annular space and the inner diameter of said outer supply means being approximately equal to the outer diameter of said annular space whereby molten metal may be supplied to

said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space during rotation of said inner and outer supply means about said axis.

5. A metal casting apparatus for casting tubes or the like, comprising, in combination, mold means defining an upwardly extending annular space having a central axis and adapted to receive molten metal; inner and outer annular molten metal supply means arranged above said mold means for supplying molten metal to said annular space, said inner and outer supply means being concentric with said annular space and rotatable about said axis, the outer diameter of said inner supply means being approximately equal to the inner diameter of said annular space and the inner diameter of said outer supply means being approximately equal to the outer diameter of said annular space; and drive means for rotating said inner and outer supply means about said axis whereby molten metal may be supplied to said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space.

6. A metal casting apparatus for casting tubes or the like, comprising, in combination, mold means defining an upwardly extending annular space having a central axis and adapted to receive molten metal; inner and outer annular molten metal supply means arranged above said mold means for supplying molten metal to said annular space, said inner and outer supply means being concentric with said annular space and rotatable together about said axis, the outer daimeter of said inner supply means being approximately equal to the inner diameter of said annular space and the inner diameter of said outer supply means being approximately equal to the outer diameter of said annular space; and drive means for simultaneously rotating both said inner and outer supply means about said axis in the same direction whereby molten metal may be supplied to said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space during rotation of said inner and outer supply means about said axis.

7. A metal casting apparatus for casting tubes or the like, comprising, in combination, mold means defining an upwardly extending annular space having a central axis and adapted to receive molten metal; inner and outer annular molten metal supply means arranged above said mold means for supplying molten metal to said annular space, said inner and outer supply means being concentric with said annular space and rotatable about said axis independently of each other, the outer diameter of said inner supply means being approximately equal to the inner diameter of said annular space and the inner diameter of said outer supply means being approximately equal to the outer diameter of said annular space; and separate drive means for rotating said inner and outer supply means, respectively, about said axis in opposite directions whereby molten metal may be supplied to said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space during rotation of said inner and outer supply means about said axis.

8. A metal casting apparatus for casting tubes or the like, comprising, in combination, mold means defining an upwardly extending annular space having a central axis and inner and outer upper edges and being adapted to receive molten metal; inner and outer annular molten metal supply means for supplying molten metal to said annular space, said inner and outer supply means being arranged above said mold means, concentric with said annular space and rotatable about said axis, said inner supply means having an outer peripheral portion adjacent said inner edge of said annular space and formed with opening means therethrough and said outer supply means having an inner peripheral portion adjacent said outer edge of said annular space and formed with opening means therethrough; and drive means for rotating said inner and outer supply means about said axis whereby molten metal may be supplied to said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space during rotation of said inner and outer supply means about said axis.

9. A metal casting apparatus for casting tubes or the like, comprising, in combination, mold means defining an upwardly extending annular space having a central axis and inner and outer upper edges and being adapted to receive molten metal; inner and outer annular molten metal supply means for supplying molten metal to said annular space, said inner and outer supply means being arranged above said mold means, concentric with said annular space and rotatable together about said axis, said inner supply means having an outer peripheral portion adjacent said inner edge of said annular space and formed with opening means therethrough and said outer supply means having an inner peripheral portion adjacent said outer edge of said annular space and formed with opening means therethrough, said opening means of said inner supply means being angularly displaced relative to said opening means of said outer supply means; and drive means for rotating said inner and outer supply means about said axis together whereby molten metal may be supplied to said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space during rotation of said inner and outer supply means about said axis.

10. A metal casting apparatus for casting tubes or the like, comprising, in combination, mold means defining an upwardly extending annular space having a central axis and inner and outer upper edges and being adapted to receive molten metal; inner and outer annular molten metal supply means for supplying molten metal to said annular space, said inner and outer supply means being arranged above said mold means, concentric with said annular space and rotatable about said axis, said inner supply means having an outer peripheral portion adjacent said inner edge of said annular space and formed with a plurality of angularly displaced inner opening means for projecting streams of molten metal issuing therethrough, respectively, different distances and said outer supply means having an inner peripheral portion adjacent said outer edge of said annular space and formed with a plurality of angularly displaced outer opening means for projecting streams of molten metal issuing therethrough, respectively, different distances; and drive means for rotating said inner and outer supply means about said axis whereby molten metal may be supplied to said annular space simultaneously from two regions located, respectively, inside and outside of an upward annular extension of said annular space during rotation of said inner and outer supply means about said axis.

11. The combination defined in claim 10 wherein at least one of said plurality of inner opening means is adapted to project a stream of molten metal issuing therethrough so that the same will impinge upon the annular liquid level of molten metal in said annular space in the region of the inner edge of said annular liquid level, wherein at least one other of said plurality of inner opening means is adapted to project a stream of molten metal issuing therethrough so that the same will impinge upon said annular liquid level in the region of the central annular portion thereof, and wherein at least yet one other of said plurality of said inner opening means is adapted to project a stream of molten metal issuing therethrough so that the same will impinge upon said annular liquid level in the region of the outer edge thereof; and wherein at least one of said plurality of outer opening means is adapted to project a stream of molten metal issuing there-

through so that the same will impinge upon said annular liquid level in said region of said inner edge thereof, wherein at least one other of said plurality of outer opening means is adapted to project a stream of molten metal issuing therethrough so that the same will impinge upon said annular liquid level in said region of said central annular portion thereof, and wherein at least yet one other of said plurality of outer opening means is adapted to project a stream of molten metal issuing therethrough so that the same will impinge upon said annular liquid level in said region of said outer edge thereof.

12. The combination defined in claim 10, and baffle means on at least one of said supply means for deflecting streams of molten metal issuing through said opening means through the peripheral portion of the other of said supply means thereby preventing the streams from impinging directly upon said mold means.

13. The combination defined in claim 10, and baffle means on at least one of said supply means and projecting into said annular space for deflecting streams of molten metal issuing through said opening means through the peripheral portion of the other of said supply means

thereby preventing the streams from impinging directly upon said mold means.

14. The combination defined in claim 10, and inner annular baffle means on said inner supply means and projecting into said annular space for deflecting streams of molten metal issuing through said outer opening means through said inner peripheral portion of said outer supply means and outer annular baffle means on said outer supply means and projecting into said annular space for deflecting streams of molten metal issuing through said inner opening means through said outer peripheral portion of said inner supply means, thereby preventing streams of molten metal from impinging directly upon said mold means.

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