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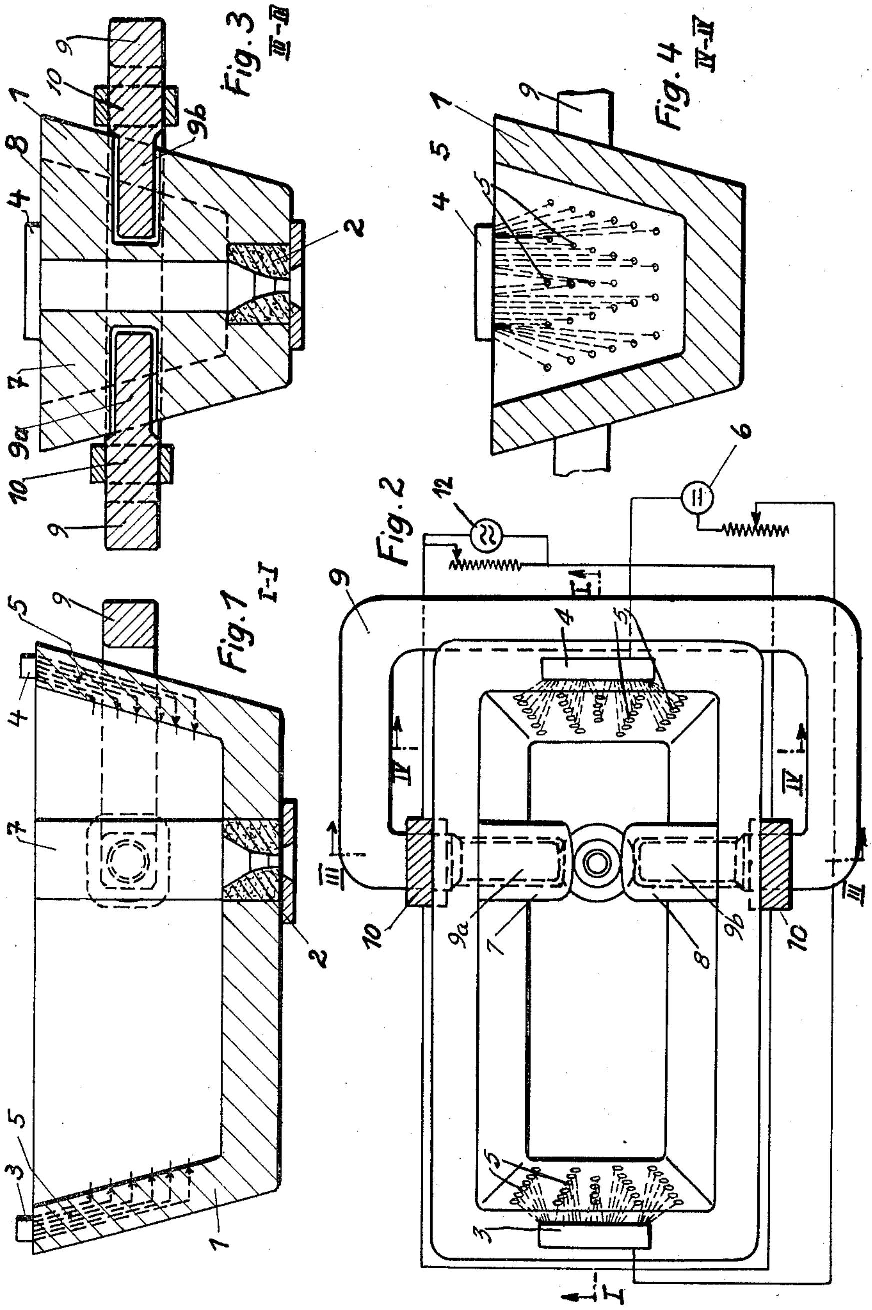
APPARATUS FOR CONTROLLING THE RATE OF FEED OF THE MELT OF CONTINUOUS CASTING PLANT

Filed Nov. 27, 1962 3 Sheets-Sheet 1



INVENTOR.
RALF SCHNEIDER

BY
Emery, Whittemore, Sandoe & Graham

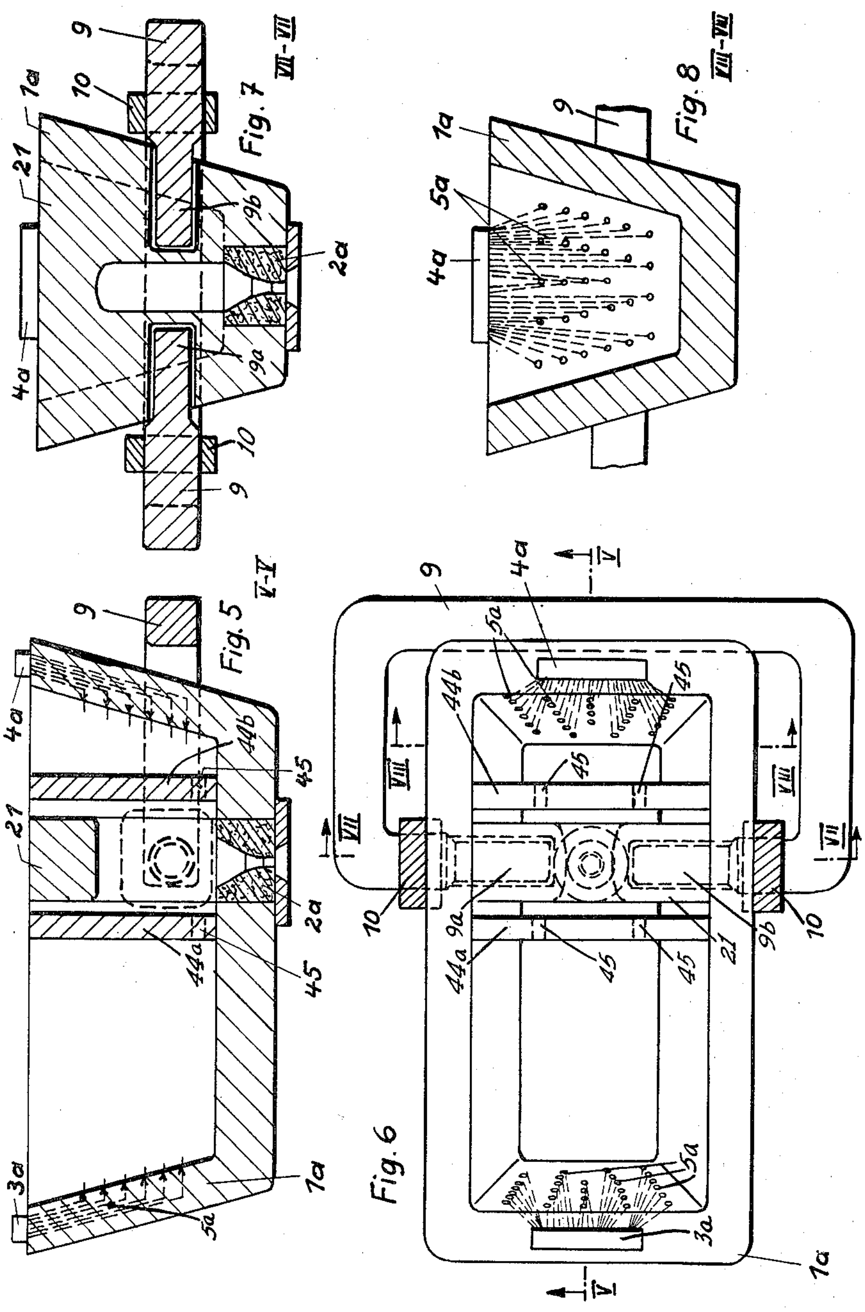


Fig. 7

Fig. 8

Fig. 5

Fig. 6

INVENTOR.
RALF SCHNEIDER

BY

Fig. 11

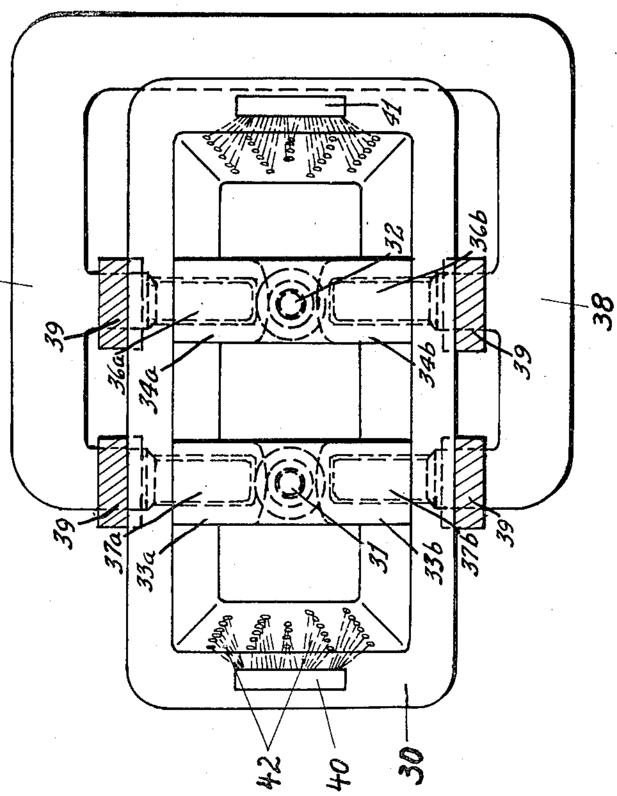


Fig. 9
IX – IX

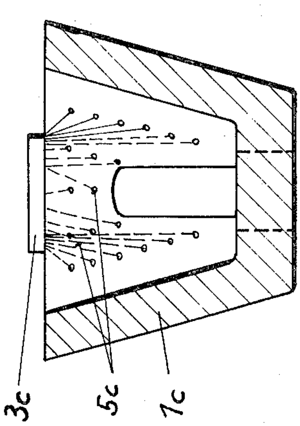
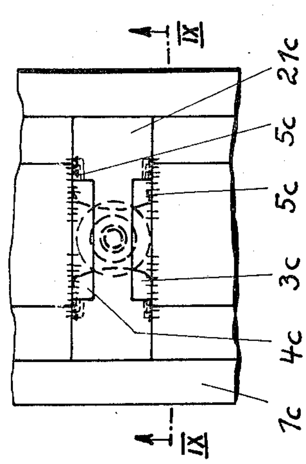


Fig. 10



INVENTOR.

RALF SCHNEIDER

BY

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APPARATUS FOR CONTROLLING THE RATE OF FEED OF THE MELT OF CONTINUOUS CASTING PLANT

Ralf Schneider, Ratingen, near Dusseldorf, Germany, assignor to Concast Aktiengesellschaft, Zurich, Switzerland

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6 Claims. (Cl. 22—57.2)

This invention relates to apparatus for controlling the rate of feed of the melt from the pouring basin of continuous casting plant. In such plants the rate of feed of the melt must be controlled to keep the casting speed constant or to vary the casting speed within intended limits.

It is already known that the rate at which the melt flows out of the pouring basin can be varied by means of an electric current passing in a horizontal plane through the melt and a horizontal magnetic field which traverses the current at right angles. In conventional plant the devices by which these features are obtained, that is to say electrodes and magnets, are located at the level of and inside the feed pipe. However, since the feed pipe requires replacement after each casting operation the presence of the said devices is a drawback when it is desired to remove the pipe. The arrangement also has other drawbacks. For instance, the thickness of the wall of the feed pipe must be rather thin to permit the effective magnetic field to be generated as closely as possible to the melt. A thin-walled feed pipe gives rise to a very steep temperature gradient between the inside and the outside of the pipe wall, causing stresses which often result in burst pipes. The considerable heat loss which is entailed also unavoidably cools the melt. Moreover, the electrodes which must be of fairly large section to carry the necessary currents, likewise reduce the cross section of the feed pipe walls. Finally, such an arrangement leads to an undue overall increase in the structural height of the plant.

It is the object of the present invention to overcome these drawbacks and to locate the means for controlling the rate of feed of the melt to the mould in a more convenient way.

For solving this problem it is proposed to locate the devices for varying the rate of feed of the melt inside the pouring basin, and to provide walls constricting the width of the basin on each side of the basin in the plane of the pouring spout in such a way that the gap between the opposed ends of the constricting walls is vertically above the spout. The poles of electromagnets are embedded in the said walls, and a current is conducted through the melt at right angles to the magnetic field, the electrodes being located at any convenient point in each of the two compartments of the pouring basin formed by the constricting walls. The apparatus proposed by the invention has the advantage that the structural height of the plant can be greatly reduced because the pouring basin can now be located directly above the permanent mould. Moreover, the provision of a relatively long feed pipe is quite unnecessary and the pouring spout may be short enough to be completely embedded in the floor of the basin. The pouring spout is therefore easily accessible for replacement when the casting operation has been completed. Moreover, the otherwise unavoidable loss of heat in a feed pipe is avoided and trouble due to a feed pipe burst cannot arise.

According to other features of the invention several walls for constricting the width of the basin may be provided if the pouring basin has several pouring spouts, and each constricting wall portion may then contain one pole of an electromagnet. The walls which constrict the width of the basin may constitute ribs inside the basin. Furthermore, the wall which constricts the width of the basin may have the form of a bridge, an opening for the passage therethrough of the melt being provided under the arch formed by the bridge directly above the pouring spout. Preferably the electrodes may be located in the end walls of the basin or in the sides of the constricting wall portions facing the end walls of the basin. Terminal plates may be located on the top of the walls of the pouring basin for electrodes which extend into the walls in the form of thin wires and curve inwards to the inside wall surfaces from which they project into the melt to make contact therewith. The wires forming the electrodes consist preferably of the same metal as the melt. Finally, a wall with an opening may be provided on each side of the wall portions which constrict the width of the basin in such manner that said additional walls define a chamber inside the pouring basin.

The invention will now be described with reference to the accompanying drawings which illustrate preferred embodiments thereof, and in which:

FIGS. 1 to 4 illustrate one embodiment of the invention, FIG. 1 being a sectional side elevation of the pouring basin, the section being taken on the line I—I of FIG. 2;

FIG. 2 is a plan view of the pouring basin;

FIG. 3 is a sectional end elevation on the line III—III of FIG. 2;

FIG. 4 is an end elevation in section of the pouring basin, the section being taken on the line IV—IV of FIG. 2;

FIGS. 5 to 8 illustrate another embodiment of the invention, FIG. 5 being a sectional side elevation of the pouring basin taken on the line V—V of FIG. 6;

FIG. 6 is a plan view of the pouring basin;

FIG. 7 is a sectional end elevation of the pouring basin, taken on the line VII—VII of FIG. 6;

FIG. 8 is a sectional end elevation on the line VIII—VIII of FIG. 6;

FIG. 9 is a cross section showing a bridge-like constricting wall portion with electrodes embedded therein, the section being taken on the line X—X of FIG. 10.

FIG. 10 is a fragmentary plan view of the bridge-like constricting wall portion, and

FIG. 11 is a plan view of a pouring basin provided with several pouring gates and a corresponding number of walls for constricting the cross section of the pouring basin above each of the pouring gates.

Referring to the drawings a pouring basin **1** is provided for holding the melt in a continuous casting plant not shown in the drawings. Such a casting plant has been described for example in United States patent specification No. 2,187,720. The pouring basin **1** has a pouring spout **2** which can be removed and replaced. Terminal bars or plates **3**, **4** rest on the top edge of the shorter end walls of the basin for supplying current down the walls through conductors **5** in the form of fine wires which at their lower ends curve inwards towards and project from the inside faces of the end walls where they make contact with the melt not indicated in the drawing.

The terminal bars **3**, **4** may be connected for instance to a generator **6**, FIG. 2, for supplying a powerful current. This current will flow therefore between the terminal bars **3** and **4** through the wire conductors **5** and through the melt in the pouring basin **1**. In a vertical plane containing the pouring spout **2**, the pouring basin **1** is formed with lateral wall portions **7** and **8** which project in the manner of thick ribs from the side walls of the basin and which thus constrict the inside cross section of the basin. Embedded in these wall portions **7** and **8** are poles **9a** and **9b** of an electromagnet. A yoke **9** carries magnet coils **10** which are supplied with alternating current from a common source of A.C. power **12** or from separate sources.

Between the coils **9***a* and **9***b* a magnetic field is thus formed in the constricted gap between the two wall portions **7** and **8**, and according to the direction of the current, this field applies a force to the melt acting either in the direction towards or away from the spout **2**. By varying the current, or the strength of the magnetic field, the force accelerating or retarding the melt can thus be adjusted and the rate of feed of the melt to the mould controlled.

FIGS. 5 to 8 illustrate an alternative form of construction of the wall portions which form a constriction in the basin above the pouring spout **2***a*. In this embodiment the wall portions have the shape of a bridge member **21** provided with an opening in alignment with the pouring spout **2***a*. The magnet poles **9***a* and **9***b* are located in the walls of the bridge member **21** on each side of said opening. The basin **1***a*, pouring spout **2***a*, current conductors **3***a* and **4***a*, terminal bars **3***a* and **4***a*, electrodes **5***a* and electromagnet **9***a*, **9***b* and coils **10** are similar to the corresponding parts illustrated in FIGS. 1 to 4. The provision of a closed bridge-like wall section **21** is advantageous from the point of view of conservation of heat.

The arrangements described according to the invention may be combined in various ways. For instance the electrodes may be located in any parts of the basin which are separated by the wall portions **7** and **21**. Moreover, the terminal plates **3**, **3***a*, **4**, **4***a* may be located on the walls **7** and **21** in such a way that the electrodes **5** and **5***a* feed the current into the melt through the wall from opposite faces thereof so that the current merely has to flow from one side of the walls **7** and **8** or **21** through the gap between the wall portions or the opening in bridge **21** to the other side of the walls.

An embodiment in which the terminal plates **3***c*, **4***c* are located on the wall portions **21***c* which constrict the width of the basin **10** is illustrated in FIGS. 9 and 10.

FIG. 11 is a plan view of a pouring basin **30** having two pouring spouts **31** and **32**. According to the size and number of spouts two wall portions **33***a*, **33***b* and **34***a*, **34***b* are provided for constricting the width of the basin **30**. Pairs of poles **36***a*, **36***b* and **37***a*, **37***b* are embedded in the walls **33***a*, **33***b* and **34***a*, **34***b* and connected by a yoke **38**. Each magnet pole **36***a*, **36***b* and **37***a*, **37***b* carries a magnet coil **39**. The magnet coils **39** are fed with current in the manner already described. From the terminal bars **40**, **41** the current flows through electrodes **42** and then through the melt, as already described. If more than two pouring spouts are provided the equipment illustrated in FIG. 11 can be modified accordingly by the provision of a sufficient number of constricting wall portions to correspond with the number of pouring spouts. The electromagnets may then be located accordingly.

In the embodiment illustrated in FIG. 11 two currents which flow through only one gap each and two independently fed pairs of electrodes may be provided. Moreover, two independently controllable magnet systems may be provided for independently controlling the rate of feed through each of the spouts. The wall portions which constrict the width of the basin are constructed from refractory material, such as zirconium silicate bricks.

As will be seen more particularly by reference to FIGS. 5 and 6 walls **44***a* and **44***b* form a chamber located on each side of wall **21** and provided with openings **45** for the passage therethrough of the melt. These prevent lateral deviation of the electrodynamic force.

The invention includes within its scope every possible combination of the several arrangements described in the illustrated embodiments.

I claim:

1. A pouring basin for a continuous casting plant, said

pouring basin comprising a walled container having bottom, side and end walls to hold molten metal, a spout positioned in the bottom wall of said container through which said molten metal flows into said continuous casting plant, constricting walls within said container, said constricting walls extending from each of said side walls and terminating astraddle said pouring spout to define a narrow gap therebetween, said gap being vertically disposed over said pouring spout, an electromagnet positioned within said protruding walls and adapted to establish a magnetic field of variable intensity extending across the gap above said spout, contact means positioned in the end walls of said basin, and a source to establish an electric current traversing said molten metal from one end wall contact to the other and passing through said gap above said pouring spout, said current being variable in amplitude and interacting with said magnetic field in said gap to control the flow of molten metal through said spout into said continuous casting plant.

2. A pouring basin in accordance with claim **1** in which said contact means comprise a plurality of thin wires imbedded in said end walls and projecting therefrom into the melt, the other ends of said wire being connected to terminal plates, said terminal plates being coupled across said source.

3. A pouring basin in accordance with claim **2** in which said wires are composed of the same metal as the molten metal within the basin.

4. A pouring basin in accordance with claim **1** in which said basin includes a plurality of spouts positioned in the bottom wall thereof, a like plurality of constricting walls extending from the side walls and forming a gap between said constricting walls and vertically positioned over each of said pouring spouts, each of said constricting walls being provided with an electromagnet to establish a magnetic field across said gap.

5. A pouring basin for a continuous casting plant comprising an open-top walled container to receive molten metal for pouring into said plant, a pouring spout in the bottom of said container, the walls of said container defining a constriction in said container vertically above said pouring spout with a gap between adjacent walls over and aligned with said spout, means within said walls of said container to establish a magnetic field and an electric current through the molten metal in said container, said magnetic field and electric current intersecting in said gap and being mutually perpendicular at said intersection, and means for varying the amplitude of said current and field for controlling the rate of pouring molten metal through said spout.

6. A pouring basin in accordance with claim **5** in which said magnetic field is an alternating field of variable amplitude and in which said electric current is a unidirectional current of variable amplitude.

References Cited by the Examiner

UNITED STATES PATENTS

1,973,431	9/34	Davenport.	
2,144,886	1/39	Mars et al.	13—26
2,177,536	4/65	Schneider	22—79
2,714,752	8/55	Wilson	22—200.1 X
2,955,333	10/60	Berry et al.	22—200.1 X
2,963,758	12/60	Pestel et al.	22—200.1 X
2,970,830	2/61	Siegfried	266—38

FOREIGN PATENTS

159,282	10/54	Australia.
751,233	6/56	Great Britain.

J. SPENCER OVERHOLSER, *Primary Examiner.*

MARCUS U. LYONS, *Examiner.*