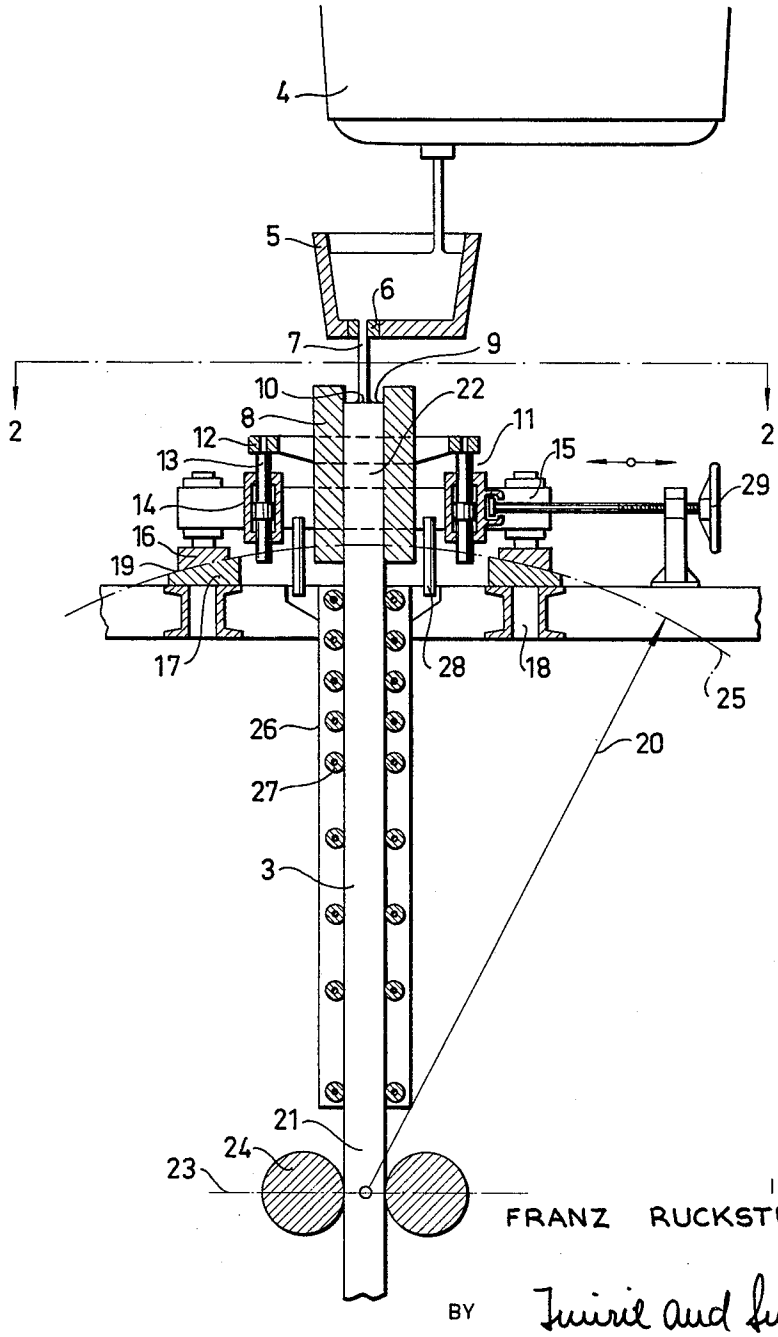
Jan. 26, 1965 F. RUCKSTUHL 3,166,803

DEVICE FOR CENTERING THE STREAM OF METAL TO THE MIDDLE OF THE MOULD DURING VERTICAL CONTINUOUS CASTING

Filed Aug. 16, 1962 2 Sheets-Sheet 1

Fig. 1

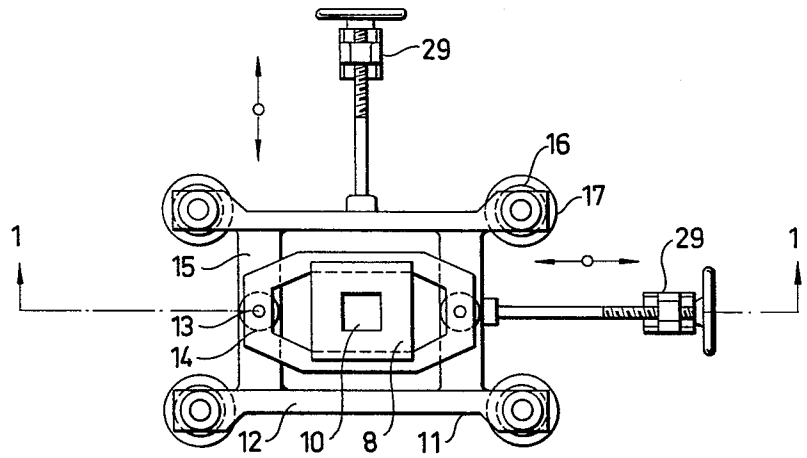



INVENTOR
FRANZ RUCKSTUHL

BY Fairie and Smiley
ATTORNEYS

Jan. 26, 1965 F. RUCKSTUHL 3,166,803
DEVICE FOR CENTERING THE STREAM OF METAL TO THE MIDDLE OF THE MOULD DURING VERTICAL CONTINUOUS CASTING
Filed Aug. 16, 1962 2 Sheets-Sheet 2

Fig. 2




INVENTOR
FRANZ RUCKSTUHL

BY Fairfield and Smiley
ATTORNEYS

United States Patent Office 3,166,803 Patented Jan. 26, 1965



3,166,803

# DEVICE FOR CENTERING THE STREAM OF METAL TO THE MIDDLE OF THE MOULD DURING VERTICAL CONTINUOUS CASTING

Franz Ruckstuhl, Uster, Zurich, Switzerland, assignor to Erik Allan Olsson, Kusnacht, Zurich, Switzerland

Filed Aug. 16, 1962, Ser. No. 217,329
4 Claims. (Cl. 22—57.2)

In most known vertical continuous casting processes for casting metals, especially steel, the molten metal is poured from a suitable ladle or the like into a refractory tundish. At its bottom is a nozzle for discharging which is intended to permit the molten metal to flow out in an uninterrupted stream as nearly vertical as possible into an open-ended mould which is ordinarily water-cooled. In said mould the metal is caused to solidify by cooling in its outer shell. The casting partially solidified in this manner, is continuously withdrawn from the lower end of the mould. As the molten metal enters the mould it is vitally important that the metal stream leaving the tundish fall into the geometric center of the (for example) circular or quadratic mould cross section in order to ensure that cooling will proceed as symmetrically as possible. However, a damaged discharge nozzle, turbulence in the tundish or the like, could cause the metal stream to spread and by falling obliquely move away from the aforesaid center of the mould.

However, movability of the tundish, suitably in the horizontal plane, makes it possible to correct this undesirable situation even during pouring. This already-known solution of the problem is, however, only satisfactory as long as it is used for machines for producing a single continuous casting.

On machines which cast two or more continuous castings simultaneously from one and the same ladle or tundish one additional task must be performed, namely distribution of the molten metal to the different moulds. If this distribution is accomplished by using a larger tundish to cover the additional moulds, it is no longer possible to individually correct, by means of the known method, the metal streams which flow simultaneously from this tundish to the different moulds.

It has been proposed that individual adjustability be achieved by arranging a separate, horizontally adjustable tundish above every mould. However, it is necessary for distribution of the molten metal to the various tundishes, to arrange a suitable device above these tundishes and beneath the ladle, for example a tilting channel for double continuous casting and distribution channels with nozzles and stoppers for multiple continuous casting. But every extra distribution device causes difficulties which bring the economical feasibility of multiple continuous casting into question. Above all, the solutions described above involve an elongation of the path which the molten metal must travel between the ladle and the various moulds, which increases temperature drops and the oxidation of the metal. Moreover these solutions increase the number of refractory tundishes which require more power for heating, thus lowering operational economy.

The purpose of this invention is to alleviate the difficulties encountered in previously known devices and the invention is principally characterized in that the mould or each individual mould in double or multiple continuous casting is individually movable so that the streams of metal can be taken from a single tundish common to all the moulds, the said tundish serving simultaneously as distributor.

In cases where the mould or moulds are reciprocated vertically during casting, a suitable version of this invention provides for a drive unit, to impart the vertical reciprocal motion to the mould, which is movable together with the mould. Thus very favourable operating conditions are achieved with, for example, a hydraulic drive unit due to its small space requirements and relatively low weight.



Since a simple, horizontal motion of the mould and its drive unit cannot be accomplished due to purely natural reasons, this motion, according to this invention, takes place along a spherical surface, the radius of which has its centre located along an extension of the centre line of the mould, suitably at the height of the first pair of powered rolls. The process provided by this invention makes it possible to move the mould together with its drive unit in such a manner that the vertical extension of the centre line of the mould, which is congruent with the centre line of the casting, always moves the shortest distance about the aforesaid centre of rotation. The sprayers for subsequent cooling of the casting are suspended in such a manner that they are forced to adjust themselves along the position of the centre line of the casting.

The process provided by this invention will be clarified in more detail in the following; references are made to the attached drawings which illustrate a continuous casting machine intended to carry out this process.

FIG. 1 shows a schematic view of the upper portion of a continuous casting machine in longitudinal cross section taken along line 1—1 in FIG. 2 which is a top view in the direction of arrows 2—2 in FIG. 1.

The liquid metal flows from a ladle 4 down into a tundish 5 and from this through a nozzle 6 in the form of a stream 7 down into an open-ended mould 8, which in itself is already known. The partially or fully solidified casting 3 in the mould 8 is drawn by powered rolls 24. Under normal conditions the stream 7 contacts the metal surface 9 at the center point 10 of the mould cross-section. The drive unit 11 which imparts to the mould a vertical reciprocating motion comprises, in the version shown in the drawing, a frame 12, piston 13, cylinder 14 and main frame 15, said main frame being provided with feet 16 resting on pedestal supports 17, which are firmly attached to the machine support frame 18. The surfaces of the feet 16 and pedestal supports 17 in contact with each other are spherical in form with a common radius 20 and center point 21, which lies on an extension of the center line of the mould 22, suitably at the height of a line 23 passing through both of the top pair of driving rolls 24. The spherical surface 25, determined by radius 20 which in FIG. 1 is shown only in one dimension, is congruent with contacting surfaces 19 which are concave on the feet and convex on the supports 17. The device for subsequent cooling 26, usually encountered on these machines, with its guide rolls 27, is flexibly or firmly attached to the main frame 15 by means of links 28 or the like. If subsequent centering of stream 7 is necessary to bring it to centre point 10, said point is moved by providing an appropriate movement of mould 8 and its entire drive unit 11 by means of adjusting devices 29. The cooling device also follows this adjustment motion, and as a result always assumes a position which is correct relative to the centre line of the mould.

The process provided by this invention is naturally not limited to the machine described herein, but can also be used in machines designed in different manners, in which provision is made for adjusting the casting relative to the mould.

I claim:

1. In a vertical continuous casting machine, a device for centering a stream of molten metal from a tundish, casting ladle, or the like, comprising a substantially horizontal support frame having an opening therethrough,

a vertical mold, a plurality of pedestal supports on said support frame each having a surface which is curved in two dimensions, and means movably supporting the mold over said opening and having surfaces complementary to and slideably engaging said curved surfaces of the pedestal supports for adjustment of the mold relative to said tundish.

2. A device as in claim 1, wherein means are further provided for reciprocating the mold vertically during casting, said means for reciprocating the mold including a drive unit which is supported by said means movably supporting the mold and being movable with the mold.

3. In a vertical continuous casting machine, a device for centering a stream of molten metal from a tundish, casting ladle, or the like, comprising a substantially horizontal support frame having an opening therethrough, a vertical mold, a plurality of pedestal supports on said support frame each having a spherical surface with radii whose centers are located on an extension of the center line of the mold, and means movably supporting the mold over said opening and on the spherical surfaces of the pedestal supports for adjustment relative to said tundish.



4. A device as in claim 3, wherein a cooling device is linked to and carried by said means movably supporting the mold, said cooling device being disposed below the mold symmetrically with respect to the center line of the mold, whereby upon adjustment movement of the mold said cooling device pivots about said center of the spherical surfaces of the pedestal supports and follows the adjustment motion of the mold.

**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,284,503 | 5/42 | Williams | 22—57.2 |
| 2,571,033 | 10/51 | Harter et al. | 22—79 |
| 2,946,100 | 7/60 | Baier et al. | 22—57.3 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 1,123,090 | 2/60 | Germany. |


MICHAEL V. BRINDISI, *Primary Examiner.*

WILLIAM J. STEPHENSON, *Examiner.*