May 9, 1967 T. L. BRAY ETAL 3,318,364

BAND SUPPORTING MEANS

Filed March 21, 1966 3 Sheets-Sheet 1

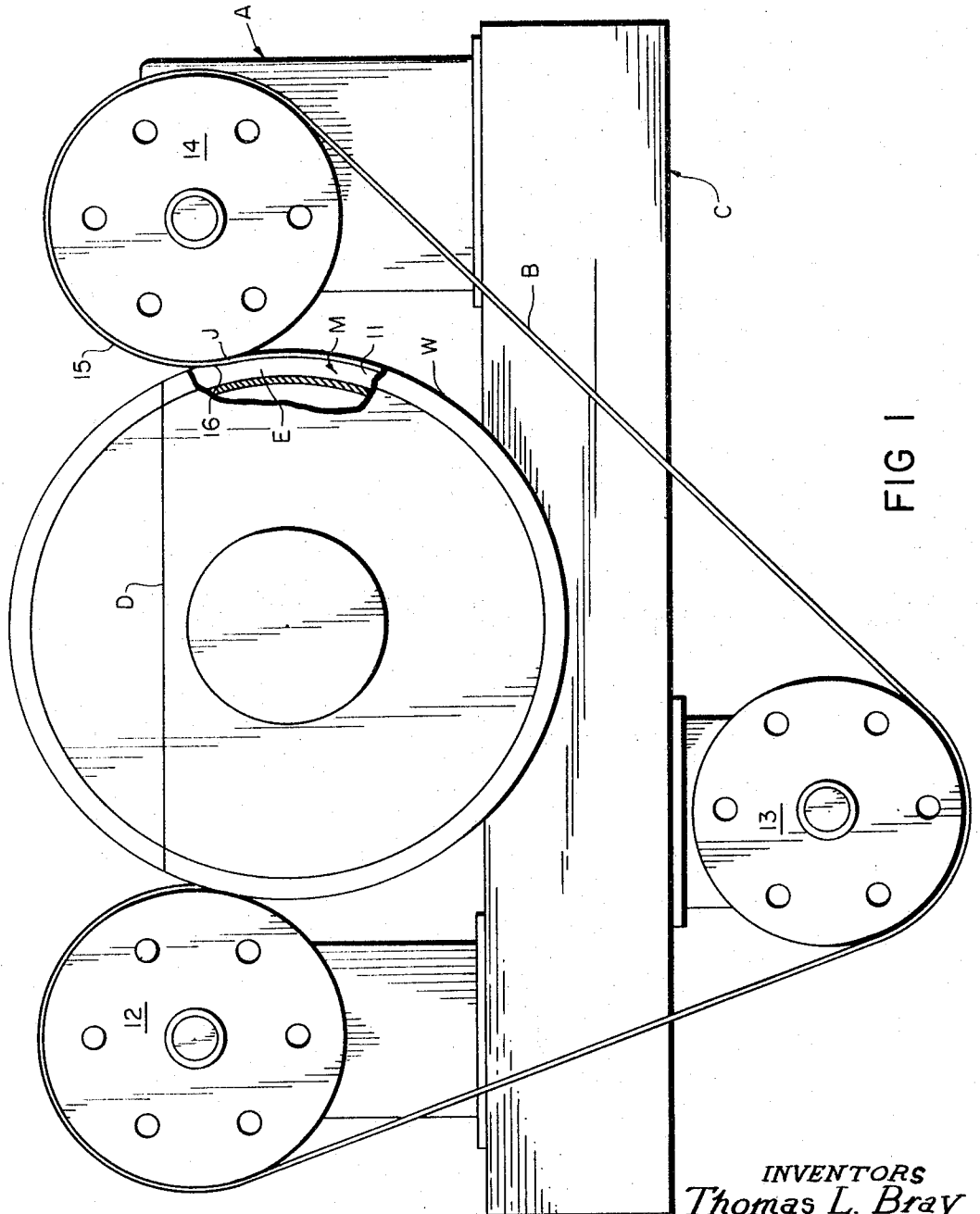

FIG 1

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BAND SUPPORTING MEANS

Filed March 21, 1966 3 Sheets-Sheet 2

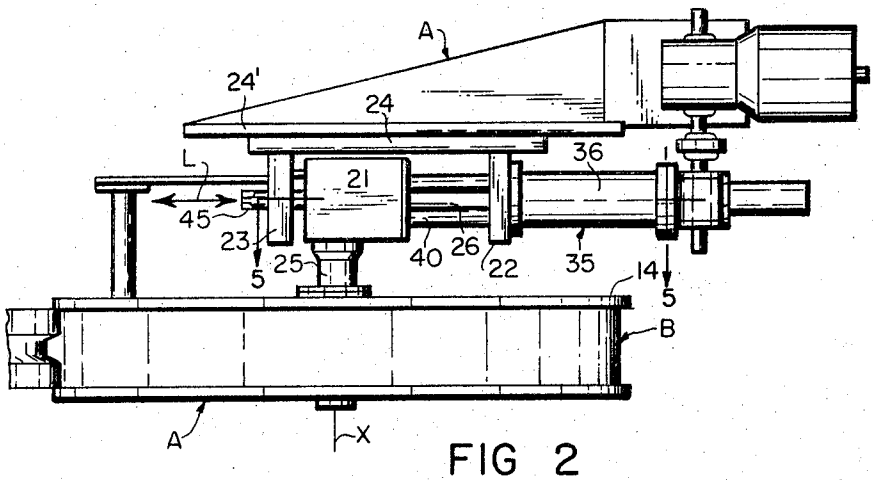

FIG 2

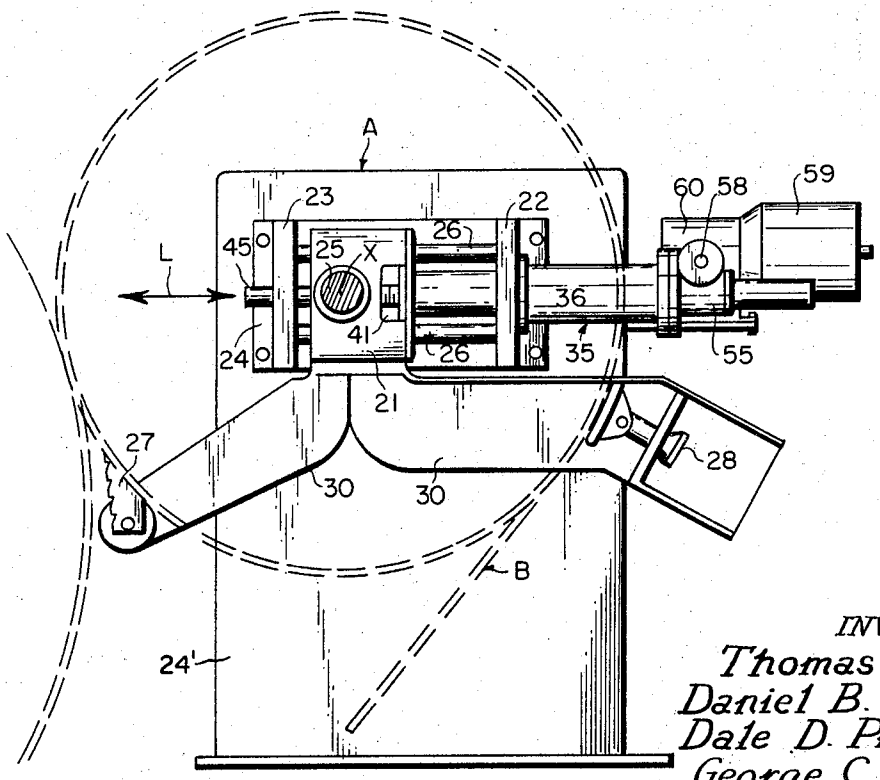

FIG 3

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BAND SUPPORTING MEANS

Filed March 21, 1966 3 Sheets-Sheet 3

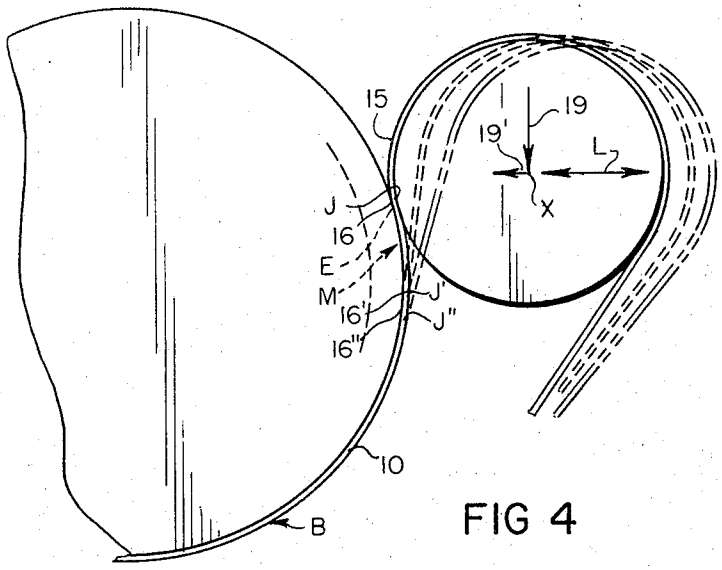

FIG 4

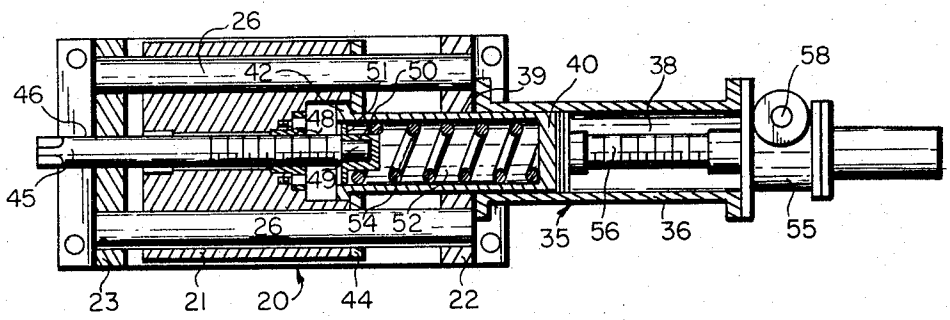

FIG 5

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United States Patent Office 3,318,364 Patented May 9, 1967

3,318,364
BAND SUPPORTING MEANS

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Filed Mar. 21, 1966, Ser. No. 535,808
7 Claims. (Cl. 164—153)

This invention relates to a band supporting means and, more particularly to a band supporting means for supporting a band in position against a rotating casting wheel to provide a mold for molten metal, the mold being defined by the band and an annular groove in the casting wheel.

In the continuous casting of metals using a rotating casting wheel having an angular groove which is partially closed by a band to form a mold, it is necessary that the band be positively urged against the casting wheel to insure the liquid integrity of the mold and prevent molten metal from passing between the band and the casting wheel and forming undesirable fins on the resulting cast metal which must be removed from the cast metal before it is rolled or otherwise used. It is also necessary that the band supporting means permit the convenient changing of the position of at least one end of the mold formed by the band and the annular groove in the casting wheel. This is because it is frequently desirable to change or adjust the point along the circumference of the casting wheel at which molten metal enters the mold in order to improve or vary properties of the cast metal and because this is most easily accomplished by changing the position of that end of the mold at which molten metal enters the mold.

Moreover, it is also necessary that a band supporting means yieldably permit the passage of a large mass of solid material between the band and the casting wheel without damage occurring to the casting wheel, the band or the band supporting means. This is because a piece of cast metal or other material will occasionally become lodged in the annular groove and will move with the annular groove to the entry end of the mold where it is engaged by the band and where it would cause damage to the casting wheel, the band or the band supporting means if the band supporting means did not permit the band to yield to a degree sufficient to accommodate the large mass of cast metal or other material.

Thus, it is apparent that a band supporting means for supporting a band in position against a rotating casting wheel must meet the requirement of firmly holding the band into engagement with the casting wheel while at the same time meeting the requirements of providing convenient adjustment of the position of the entry end of the mold and of providing yieldable motion of the band to accommodate the passage of a large mass of cast metal or other material between the band and the casting wheel.

These requirements have not been effectively met by the prior art. This is because some of the devices used in the prior art to provide a band supporting means have met some but not all of these requirements and because none of the devices used in the prior art to provide a band supporting means have effectively met all of these requirements.

The band supporting means disclosed herein effectively meets all of these requirements by supporting a flexible band adjacent one end of the portion of the band engaging a casting wheel to form a casting mold in a manner which permits adjustable and resilient yieldable motion of the band adjacent this end along a line of motion which is substantially parallel to a chord of the casting wheel. Adjustable motion of the band along this line of motion serves to vary the position along the circumference of the casting wheel of the entry end of the mold formed by the band and the annular groove in the casting wheel. Resilient yieldable motion of the band along this line of motion

provides for the passage of a large mass of cast metal or other material between the band and the casting wheel without damage to the casting wheel, the band or the band supporting means.

Moreover, since both the adjustable motion and the resilient yieldable motion of the band is along a line of motion substantially parallel to a chord of the casting wheel, the adjustment of the position of one end of the mold and the avoiding of damage from a large mass of cast metal or other material are both accomplished while at the same time effectively maintaining the band in engagement with the casting wheel. This is because the weight of the molten metal or the cast metal in the mold tending to pull the band away from the casting wheel acts in a line of force which is transverse to the line of motion in which the band is adjustably or yieldably movable. It is also because the force required for yieldable motion of the band along this line of motion may be varied to insure that any component of the line of force is effectively resisted while still providing yieldable motion.

Thus, when the other end of that portion of the band engaging the casting wheel is positioned relative to the casting wheel by a fixedly positioned support wheel and when band tension is maintained by a tensioning wheel or other conventional means, the band supporting means disclosed herein serves to insure that that portion of the band engaging the casting wheel is uniformly positioned against the casting wheel while at the same time providing for adjustment of the entry end of the mold along the circumference of the casting wheel and for the passage of a large mass of metal or other material between the band and the casting wheel. In addition, the band supporting means provides for the support of band related devices such as those for band cooling or wiping in a manner which causes their positions to be coordinated with changes in band position.

These and other features and advantages of the invention will be more clearly understood from the following detailed description and the accompanying drawings in which like characters of reference designate corresponding parts throughout and in which:

FIG. 1 is a schematic representation of a casting apparatus of a type in which the band supporting means embodying the invention may be used;

FIG. 2 is a top plan view of an embodiment of the band supporting means of FIG. 1, and includes a portion of the band and the casting wheels;

FIG. 3 is a side elevation view of that embodiment of the band supporting means shown in FIG. 2 with the band wheel and portions of the band and casting wheel shown in dashed line for clarity;

FIG. 4 is a schematic representation of a portion of the casting apparatus shown in FIG. 1 showing the band wheel in three positions and the resulting change in the position along the circumference of the casting wheel of the entry end of the mold formed by the band and casting wheel;

FIG. 5 is a sectional view of the actuating portion of the baand supporting means taken substantially in line 5—5 in FIG. 2.

These figures and the following detailed description disclose a specific embodiment of the invention but the invention is not limited to the details disclosed herein since it may be embodied in other equivalent forms.

The band supporting means disclosed herein is best understood in terms of a band supporting means A for supporting one end of the arcuate portion **10** of a band B which engages a casting wheel W to close an arcuate length of an annular groove **11** in the casting wheel W so as to form a mold M defined by the walls of the annular groove **11** and the arcuate portion **10** of the band B.

That end of the arcuate portion **10** of the band B remote from the band supporting means A is supported by a fixedly positioned support wheel **12**. In a casting machine C such as that schematically shown in FIG. 1, the band B is continuous and passes from the support wheel **12** back to the band supporting means A under a tension wheel **13**.

The tension wheel **13** serves to maintain tension in the band B so that the arcuate portion **10** of the band B is urged against the casting wheel W between the band supporting means A and the support wheel **12**. It will be understood by those skilled in the art that the casting machine C schematically shown in FIG. 1 is conventional with respect to the arrangement of the band B and the casting wheel W and that if the band supporting means A and support wheel **12** are fixedly positioned and the tension wheel **13** is properly positioned, the arcuate portion **10** of the band B will be urged against the casting wheel in a manner which will be effective to prevent molten metal from passing between the band B and the casting wheel W so as to form objectionable fins on the cast metal.

However, it will also be understood that simply fixedly positioning the band supporting means A will not provide for adjustment of the point aong the circumference of the casting wheel W of the entry E of the mold M and will not provide for the passage of a large mass of cast metal or other material between the band B and the casting wheel W. It is to the meeting of these requirements while at the same time cooperating with the support wheel **12** and the tensioning wheel **13** in maintaining the arcuate portion **10** of the band B firmly against the casting wheel W that the band supporting means A disclosed herein is ideally suited.

Broadly considered, the band supporting means A disclosed herein comprises a band wheel **14** and positioning means for adjustably and yieldably positioning the axis of rotation X of the band wheel **14** along a line of motion L which is substantially parallel to a chord D of the casting wheel W. It is the adjustable motion of the axis of rotation X of the band wheel **14** along such a line of motion L which permits that point along the circumference of the casting wheel W which corresponds to the entry E of the mold M to be changed or adjusted. This is best shown in FIG. 4 which shows the band wheel **14** in three positions along a line of motion L parallel to a chord D of the casting wheel W.

From FIG. 4, it will be seen that the arcuate portion **10** of the band B is continuous with a second portion **15** of the band B which extends from the arcuate portion **10** of the band B around the band wheel **14**. This second portion **15** of the band B is tangential to the casting wheel W at the junction J of the second portion **15** with the arcuate portion **10** of the band B. More importantly, it will be understood that the point **16** along the circumference of the casting wheel W at which the junction J of the band B is tangential to the casting wheel W substantially coincides with the end E of the mold M. Thus, movement of the point **16** at which the junction J of the band B is tangential to the casting wheel W serves to change or adjust the position along the circumference of the casting wheel W of the entry E of the mold M.

From FIG. 4, it will be seen that motion of the axis of rotation X of the band wheel **14** along a line of motion L parallel to the chord D of the casting wheel W serves to move the junction J and thus the point **16** along the circumference of the casting wheel W. It is in this manner that adjustable motion of the band wheel **14** along the line of motion L permits the position of the entry E of the mold M to be changed or adjusted along the circumference of the casting wheel W. Since the position of the end of the arcuate portion **10** opposite to that at the junction J is fixed by the support wheel **12**, the length of the arcuate portion **10** of the band B and of the mold M changes as the position of the entry E of the mold M is changed or adjusted.

It will also be understood from FIG. 4, that with the casting wheel W rotating in the direction indicated by the arrow **18**, a large mass of cast metal or other material passing between the casting wheel W and the band B will tend to force the band wheel **14** away from the casting wheel W and that resilient yieldable motion of the band wheel **14** along the line of motion L in response to the force exerted by the large mass of cast metal or other material will permit the passage of the large mass of cast metal or other material between the band B and the casting wheel W without damage to the casting wheel W, the band B, or the band supporting means A.

The mounting of the band wheel **14** for adjustable and resilient yieldable motion only along a line of motion L parallel to a chord D of the casting wheel W also serves, in combination with the wheels **12** and **13**, to hold the arcuate portion **10** of the band B in firm engagement with the casting wheel W as shown in FIG. 4. From FIG. 4, it will be seen that the force **19** which is exerted by the total weight of the molten metal and the cast metal in the mold M acting on the band B and which tends to pull the band B away from the casting wheel W is in a generally downwardly direction at the band wheel **14** of the band supporting means A. Thus, the force **19** which must be resisted by the band supporting means A in order to hold the band B firmly in engagement with the casting wheel W is generally transverse to the line of motion L in which the band wheel **14** is adjustably and yieldably movable. At most, only a relatively small component **19'** of the force **19** acts along the line of motion L along which the band supoprting means A is adjustably and yieldably movable. The force required for yieldable motion of the band supporting means A is readily varied to prevent yieldable motion of the band supporting means A in response to the component **19'** so that at each position of adjustable motion, the band supporting means A is fixedly positioned except for resilient yieldable motion in response to force along the line of motion L greater than that of the component **19'**.

In that specific embodiment of the band supporting means A disclosed herein, the positioning means by which the band wheel **14** is supported for adjustable and resilient yieldable positioning and movement of its axis of rotation X along a line of motion L parallel to a chord D of the casting wheel W is provided by the actuating portion **20** of the band supporting means A. The actuating portion **20** comprises a block **21** slideably positioned between a wall **22** and a wall **23** carried by a mounting plate **24**. The mounting plate **24** is supported by a base **24'** which serves to position the mounting plate **24**, the walls **22** and **23**, and the block **21** adjacent the casting wheel W.

The band wheel **14** is rotatably carried by the block **21** by rotatably mounting one end of its axle **25** in conventional manner in the block **21**. The block **21** is slideably positioned between the walls **22** and **23** by a plurality of shafts **26** which extend through the block **21** and which have their ends journalled in conventional manner in the walls **22** and **23**. It will be understood that the shafts **26** are positioned with their centerlines parallel to a chord D of the casting wheel W and that as a result the block **21** moves between the wall **22** and the wall **23** along a line of motion L which is parallel to a chord D of the casting wheel W.

More importantly, it will be understood that the axle **25** of the band wheel **14** and the axis of rotation X of the band wheel **14** are substantially transverse to this line of motion L of the block **21** and that movement of the block **21** along the line of motion L causes a corresponding linear movement of the band wheel **14** along a line of motion L such as that shown in FIG. 4. Thus, in that embodiment of the invention disclosed herein, adjustable and resilient yieldable movement of the block

21 between the walls 22 and 23 is used to provide the adjustable and resilient yieldable motion of the band supporting means A along a line of motion L parallel to a chord D of the casting wheel W.

The adjustable and resilient yieldable motion of the block 21 is provided by a positioning assembly 35 comprising a tubular guide member 36 attached to the wall 22 and having a cylindrical passage 38 therethrough communicating with an aperture 39 through the wall 22 of equal diameter and aligned with the passage 38. A positioning sleeve 40 is slideably received in the passage 38 and aperture 39 and has a flange 42 at that end between the walls 22 and 23.

The block 21 has a circular channel 41 extending into that end adjacent the wall 22 and the flange 42 of the sleeve 40 is slideably inserted therein. A cap plate 44 is attached to the block 21 adjacent the channel 41 to encircle the sleeve 40 and retain the flange 42 within the channel 41 of block 21. A threaded tension adjustment rod 45 extends through the block 21 from that end opposite the cap plate 44 and into the channel 41. The rod 45 also slideably extends through an aperture 46 in the wall 23 and is adapted on its extending outer end to receive a conventional wrench (not shown) thereon to turn the rod 45 with respect to a threaded member 48 fixedly positioned in the block 21 at the inner end of the channel 41.

The inner end of the rod 45 has a reduced portion 49 adapted to slideably and rotatably receive a bearing cap 50 having a flange 51. The flange 51 is appropriately shaped to be slideably inserted in a central cylindrical recess 52 extending into the sleeve 40. A resilient means such as a compression spring 54 is positioned within the recess 52 so as to engage the sleeve 40 at one end while engaging the flange 51 of the bearing cap 50 at its other end. Since the cap plate 44 retains the flange 42 of the sleeve 40 in the channel 41 and since the rod 45 serves to move the cap 50 with respect to the sleeve 40, the tension on the spring 54 is varied by turning the rod 45. Thus, the rod 45 serves as an adjusting means for adjusting the tension applied by the spring 54.

It will now be seen that if the position of the sleeve 40 is fixedly positioned in the guide member 36, the spring 54 is urging the rod 45 and the block 21 toward the wall 23 with a force dependent upon the position of the rod 45 within the recess 52. Thus, if a force exerted on the block 21 toward the wall 22 is sufficiently large to overcome the force exerted by the spring 54 on the block 21 toward the wall 23, the block 21 moves along the line of motion L toward the wall 22 until the flange 42 engages the inner end of the channel 41. It is in this manner that the band supporting means A provides for that yieldable motion of the band wheel 14 and band B required for a large mass of molten metal or other material to pass between the casting wheel W and the band wheel 14. It will be understood that after each such yieldable motion, the block 21 and the band wheel 14 are resiliently returned to a stationary position determined by the position of the flange 42.

It will also be understood that it is by adjustable motion of the flange 42 that the position of the block 21 is adjusted to provide for that adjustable motion of the band wheel 14 required to vary the position of the entry E of the mold M. This is accomplished by a conventional screw jack 55 attached to the extending end of the guide member 36 and having its central shaft 56 rotatably attached to the extending end of the sleeve 40. Operation of the screw jack 35 by rotation of its input shaft 58 by a motor 59 through a drive connection 60 serves to move the central shaft 60 within the guide member 36 and this in turn serves to move the flange 42 of the sleeve 40 between the walls 22 and 23. Adjusting the position of the flange 42 adjusts the positions of the block 21 and provides adjustable motion of the band wheel 14 along the line of motion L.

From the foregoing, it will now be seen that that embodiment of the band supporting means A disclosed herein positions one end of a band B for both adjustable and resiliently yieldable motion along a line of motion L which is substantially parallel to a chord D of a casting wheel W. The adjustable motion of the band supporting means A provides for the entry E of the mold M to be conveniently adjusted or changed along the circumference of the casting wheel W and the resilient yieldable motion of the band supporting means A provides for that yieldable motion required to insure that a large mass of cast metal or other material will not damage the casting wheel W, the band B, or the band supporting means A while at the same time providing for the return of the band wheel 14 to that position along the line of motion L at which it is stationarily positioned using its adjustable motion. Moreover, it will be seen that the band supporting means A permits the convenient varying or adjustment of the force required for yieldable motion of the band supporting means A so that yieldable motion may be made selectively responsive to the force exerted by material tending to force the band B away from the casting wheel W and to any component of a force 19 tending to pull the band B from the casting wheel W.

In addition, it should be noted that the band supporting means A disclosed herein permits the convenient positioning of devices such as a band spray 27 or a band wiper 28 so that their positions are changed simultaneously with the changing in position of the band B. This is best shown in FIG. 3 where it will be seen that the positioning of a band spray 27 or other conventional cooling means adjacent the band B by mounting the band spray 27 on an arm 29 carried by the block 21 will result in a motion of the band spray 27 which corresponds to the motion of the band wheel 14 and which will insure that the band spray 27 is always properly positioned relative to the band B regardless of the position of the entry E of the mold M along the circumference of the casting wheel W.

Similarly, the positioning of a band wiping device 28 or other conventional band cleaning means at the end of the arm 30 carried by the block 21 serves to insure that the band wiping device 28 is always properly positioned with respect to the band B regardless of the changes in band position required to adjust or change the position of the entry E of the mold M along the circumference of the casting wheel W or to provide for the passage of a large mass of cast metal or other material between the casting wheel W and the band supporting means A. Thus, the band supporting means A disclosed herein not only provides an efficient means for supporting the band B but also provides an efficient means for coordinating the positioning of such band related devices as a band cooling device 27 or a band wiping device 28 relative to the band B.

It will be obvious to those skilled in the art that many variations may be made in the embodiments chosen for the purpose of illustrating the present invention without departing from the scope thereof as defined by the appended claims.

What is claimed as invention is:

1. In a casting machine; a casting wheel having an annular casting groove formed therein; a band having an arcuate portion engaging said casting wheel and closing a length of said casting groove to form a mold having an entry end for receiving a molten metal, said band having a second portion continuous with said arcuate portion and tangential to said casting wheel substantially at said entry end of said mold; and band supporting means positioned adjacent said entry end of said mold for supporting said second portion of said band with a band wheel over which said band passes between said casting wheel and a means independent of said band supporting means for maintaining a substantially constant tension

in said band, said band supporting means including power means for moving said band wheel into a plurality of stationary positions relative to said casting wheel along a line of motion which is substantially parallel to a chord of said casting wheel and said band supporting means including resilient means for allowing yieldable movement of said band wheel from each of said plurality of stationary positions along said line of motion; the arrangement of said band supporting means being such that each of said plurality of stationary positions of said band wheel along said line of motion provides a particular position of said entry end of said mold and being such that said yieldable movement of said band wheel allows the separation of said casting wheel and said band wheel for the relatively upobstructed passage of an object between said casting wheel and said band wheel.

2. The casting machine of claim 1 wherein said band supporting means includes adjusting means for adjusting the force applied by said resilient means.

3. The casting machine of claim 1 wherein said resilient means allows yieldable movement of said band wheel only in a direction away from said casting wheel.

4. The casting machine of claim 1 including cooling means for directing a coolant against said arcuate portion of said band adjacent said second portion.

5. The casting machine of claim 4 wherein said cooling means is movable relative to said casting wheel along a line of motion substantially parallel to said line of motion of said band wheel.

6. The casting machine of claim 1 including cooling means for directing coolant against said arcuate portion of said band, said cooling means being movable by said power means simultaneously with said band supporting means.

7. The casting machine of claim 1 including band cleaning means movable by said power means for cleaning said band as said band moves relative to said cleaning means.

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