United States Patent [19]

Properzi

[11] **3,868,989**

[45] **Mar. 4, 1975**

[54] **APPARATUS FOR CONTINUOUS CASTING WITH A NUMBER OF CASTING POSITIONS**

[76] Inventor: **Giulio Properzi,** Via Pietro Cossa 1, Milan, Italy

[22] Filed: **May 8, 1973**

[21] Appl. No.: **358,433**

[30] **Foreign Application Priority Data**

May 10, 1972 Italy 24182/72

[52] **U.S. Cl.** **164/278**

[51] **Int. Cl.** **B22d 11/06**

[58] **Field of Search** 164/87, 278

[56] **References Cited**

UNITED STATES PATENTS

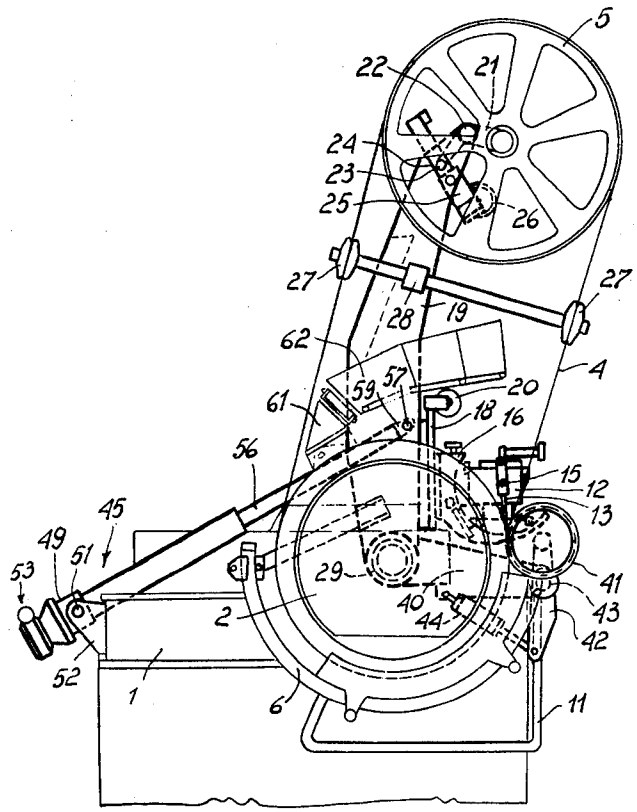
2,749,584	6/1956	Fey et al.	164/278
3,710,846	1/1973	Properzi	164/278
3,735,802	5/1973	Chia et al.	164/278
3,785,428	1/1974	Hazelett et al.	164/278

Primary Examiner—Francis S. Husar
Assistant Examiner—John E. Roethel
Attorney, Agent, or Firm—Dr. Guido Modiano; Dr. Albert Josif

[57] **ABSTRACT**

Apparatus for continuous casting having a plurality of casting positions and comprising a casting wheel with a metal band associated therewith and a crucible for feeding molten metal to the casting wheel. The apparatus further comprises a roller for pressing the band at the feed portion, and an idle pulley for stretching the band. The crucible, the pressing roller and the idle pulley are mounted on a support structure hinged to the base frame of the apparatus coaxially with the casting wheel. The support structure consists of a column and it can be rotated through a certain arc by suitable drive means.

4 Claims, 8 Drawing Figures



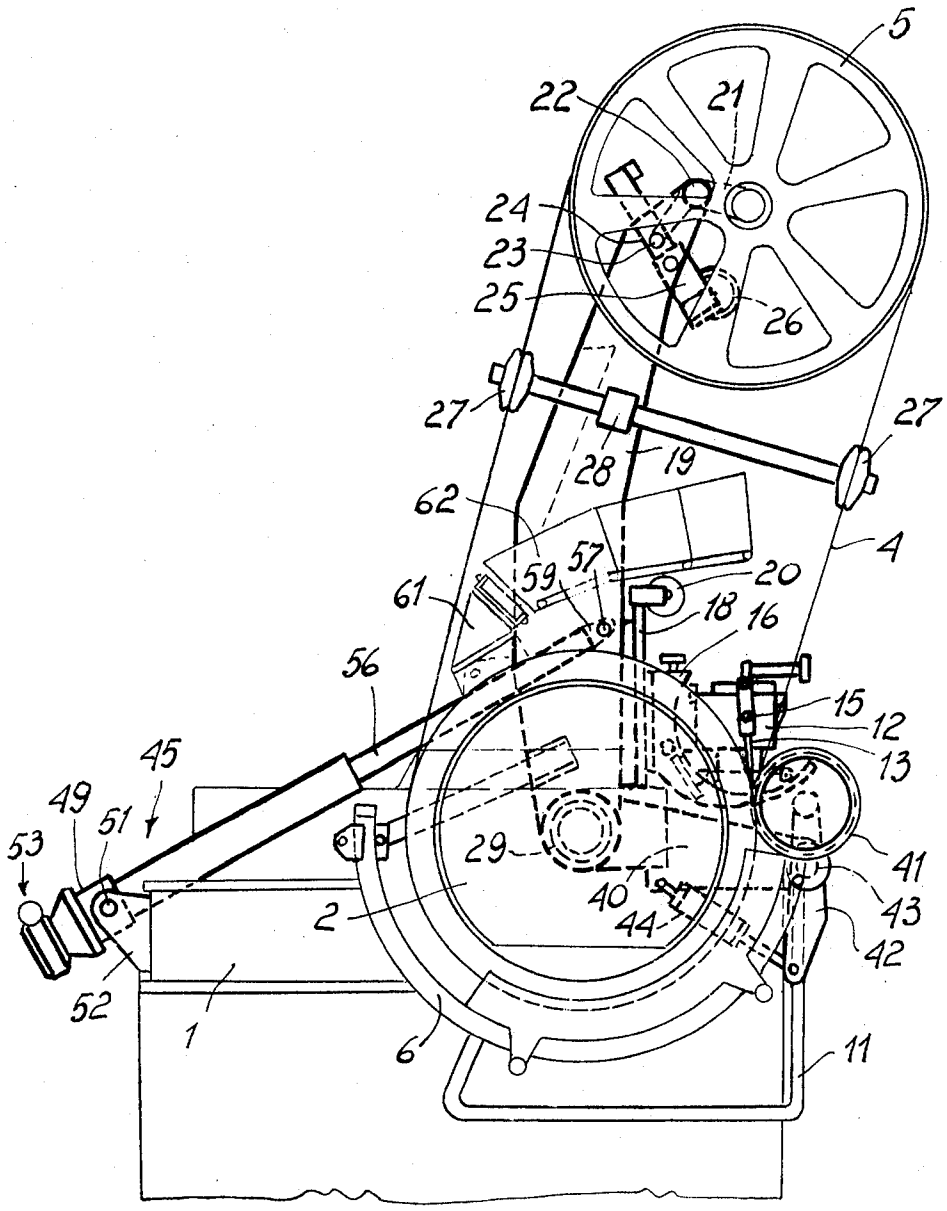

5
22
21
24
23
25
26
27
27
28
19
62
4
59
57
20
61
18
16
56
15
12
13
45
49
51
53
29
41
40
43
44
42
2
52
1
6
11

Fig. 1

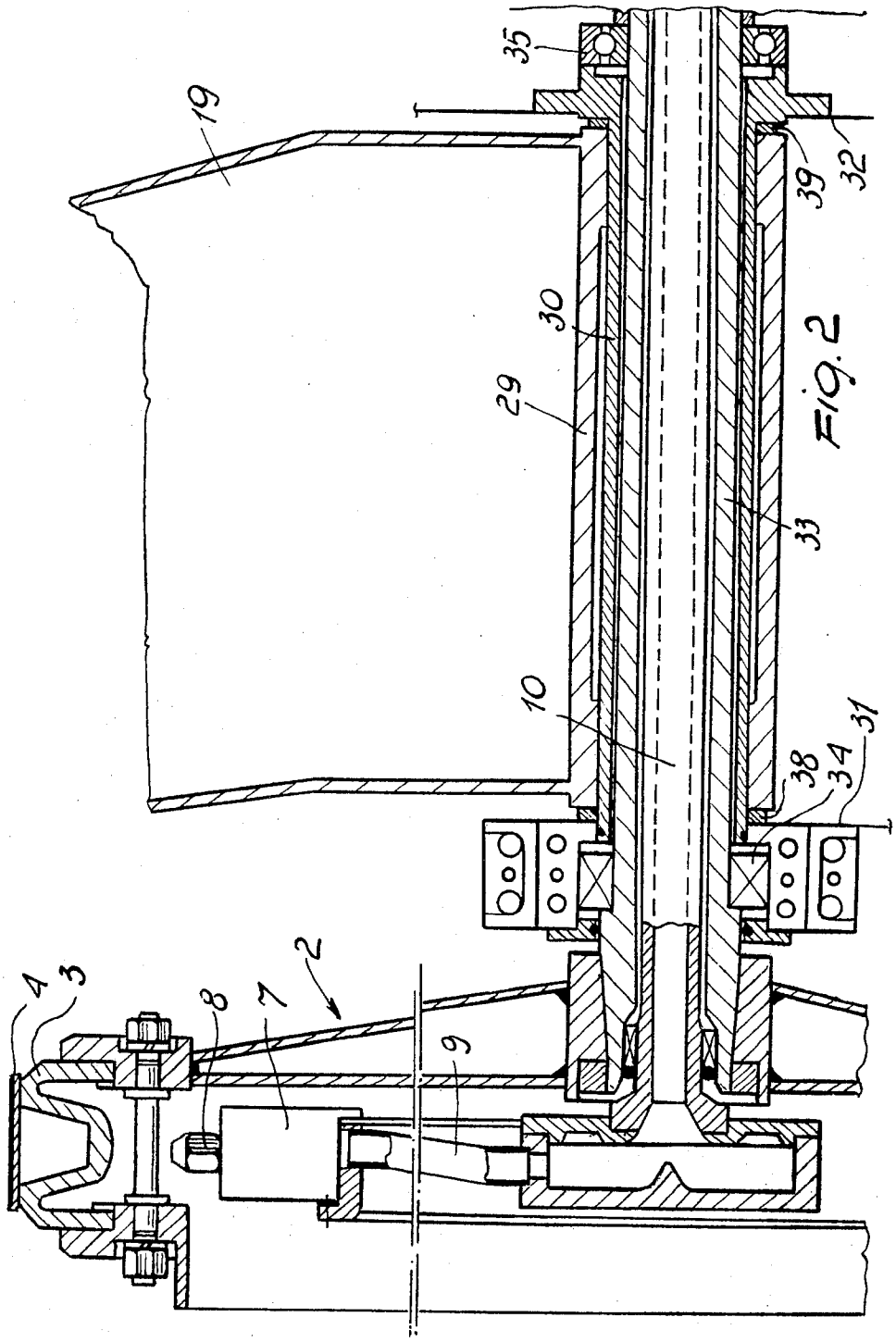


Fig. 2

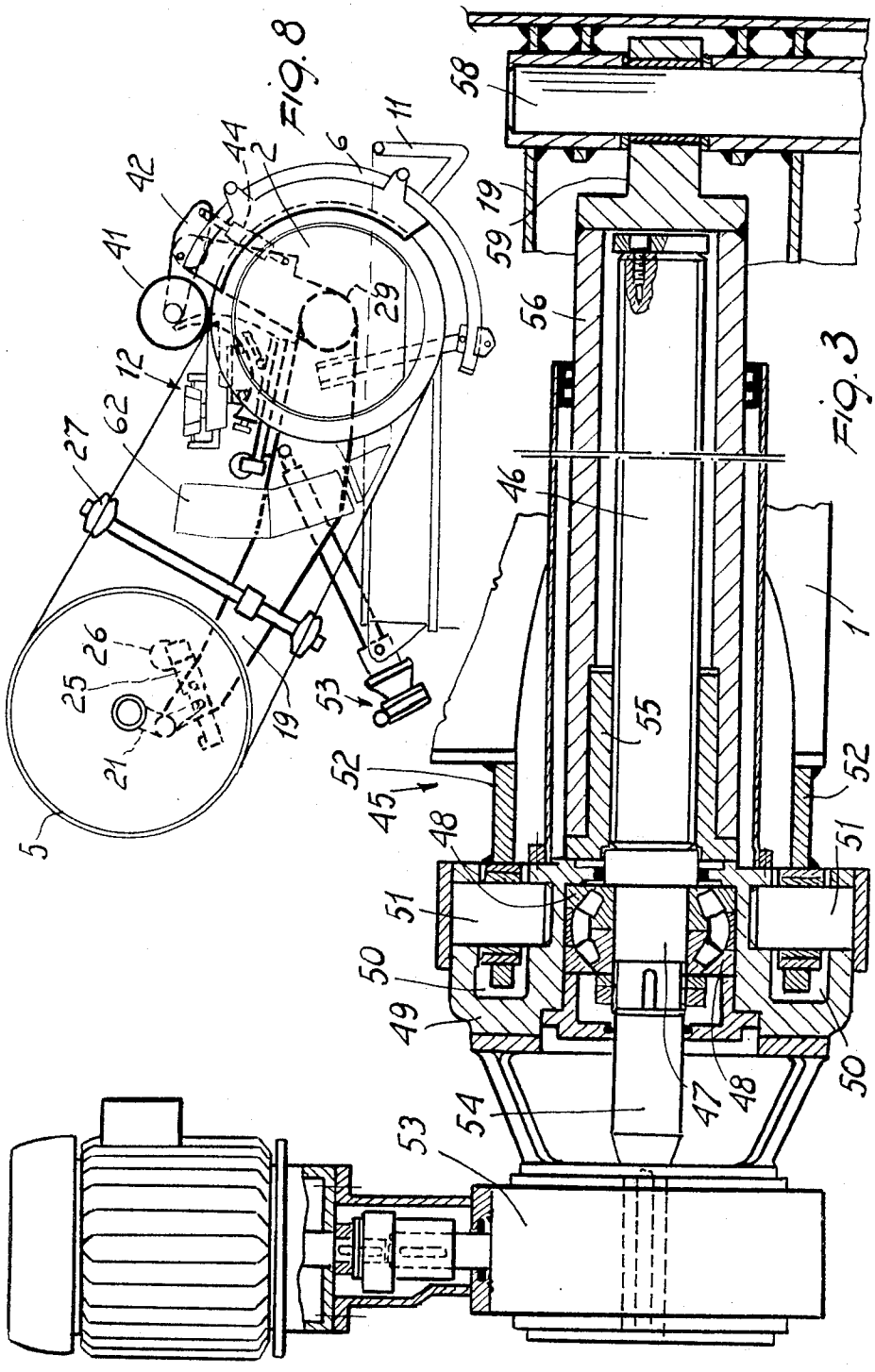


Fig. 8
Fig. 3
58
59
19
56
46
1
55
52
45
48
51
50
49
54
53
47
11
6
2
44
42
41
29
12
62
27
26
25
21
5

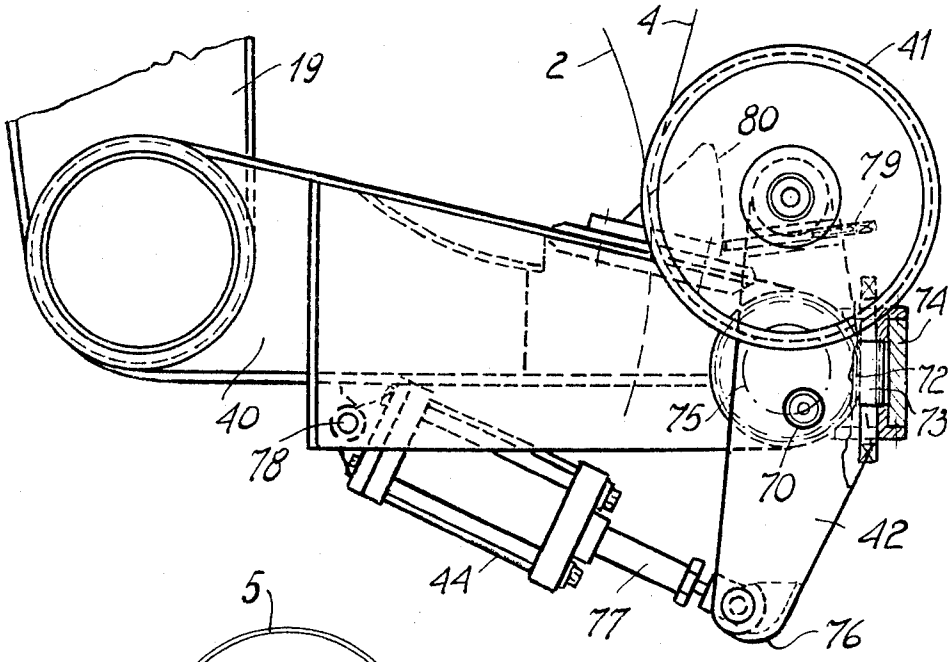

19
2
4
41
80
79
74
72
73
40
78
75
70
42
44
77
76

Fig. 4

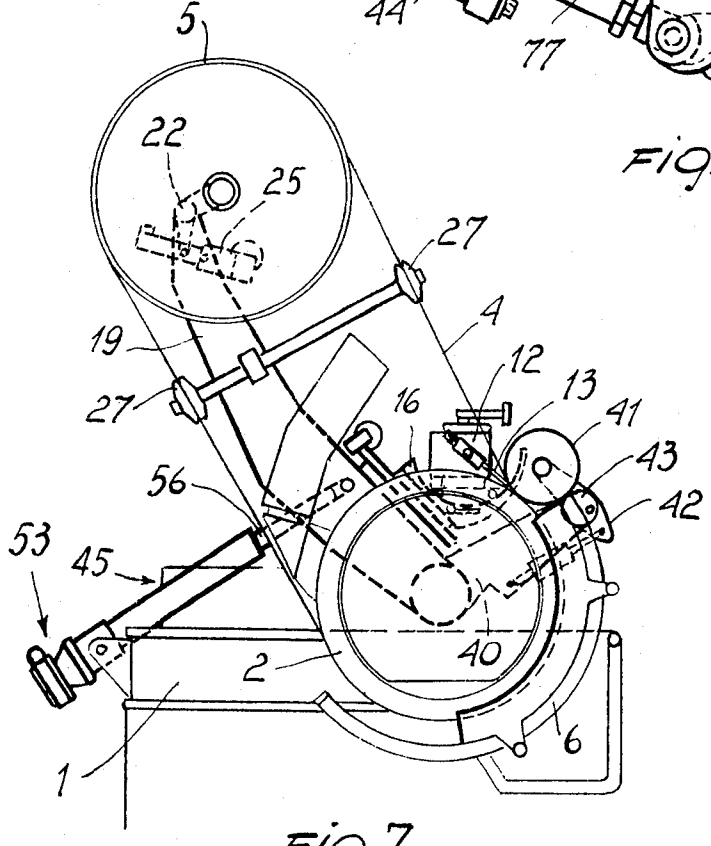

5
22
25
27
19
4
12
13
41
43
42
27
16
56
10
53
45
40
2
6
1

Fig. 7

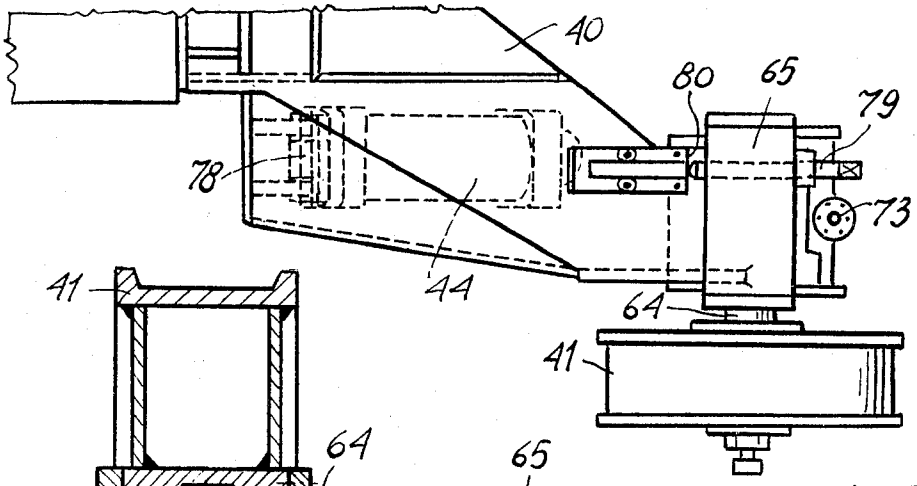


Fig. 5

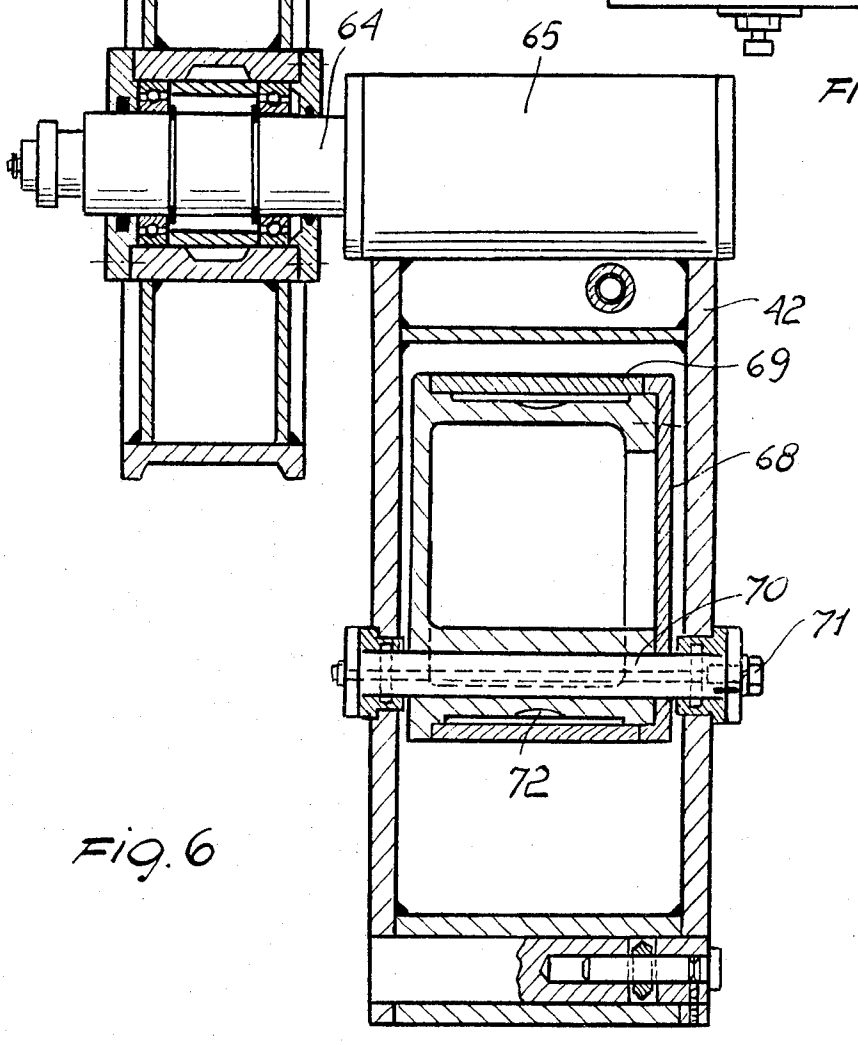


Fig. 6

APPARATUS FOR CONTINUOUS CASTING WITH A NUMBER OF CASTING POSITIONS

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for continuous casting with a number of casting positions.

In apparatus for continuous casting, in which a continuous bar is formed by the rotation of a casting wheel provided on its periphery with a groove partially closed by a metal band for receiving the molten metal for forming the bar, casting is carried out by means of a crucible standing above the wheel and provided with a nozzle which penetrates into the groove for the purpose of feeding the molten metal into it. The positions of this crucible and the nozzle are notably adjusted in such a manner as to feed the molten metal at different angles, in other words the crucible may be arranged with the nozzle vertical or with the nozzle almost horizontal or in an intermediate position.

The choice of these positions is mainly determined by the type of metal to be cast and the practice of the person who operates the casting apparatus.

In apparatus in which the crucible can be positioned at will, means must also be provided for varying the position of the metal band relative to the feed point of the metal, where a band pressing roller is disposed.

To carry out this operation it has been proposed by the same applicant that the crucible, the band pressing roller and other auxiliary devices be mounted on a rotating structure with its axis coincident with that of the wheel. However with this solution, which is very effective because of the numerous casting positions which it allows, each time the casting position is changed, the position of the band also has to be changed, and in particular of the idle pulley for the band mounted above the wheel. The movement of the pulley from a position above the casting wheel to a position more or less angularly displaced from the vertical is carried out by manually fixing the pulley in a number of positions on an arm rigid with the column which supports the pulley. It is also necessary each time to change the band, because its length changes. This operation, which is carried out separately from the operation of adjustment of the crucible casting position, requires not only a considerable time during which the apparatus must remain inactive, but also the assistance of a number of workers and hoisting means in addition to the fact that for each casting position a band of determined length is necessary. If one considers that the band is very thin and subject to considerable thermal and mechanical stresses, and has thus a limited life, the need to have available numerous bands of different lengths considerably increases the operating costs of the casting apparatus.

It should also be noted that the support structure for the idle pulley is considerably bulky, as it has to allow a large movement between the extreme positions of the pulley itself.

The manual operation of moving and locking the spindle of the pulley is very heavy and tiring, because of which one often foregoes carrying out the casting in the most advantageous position so as not to have to carry out these arrangement operations.

SUMMARY OF THE INVENTION

The object of the present invention is to overcome all these disadvantages by providing a continuous casting apparatus in which casting may be carried out in positions, variable between the vertical and horizontal position, without it being necessary to carry out complicated separate adjustment operations on the other machine members, such as the idle pulley.

A further object of the invention is to provide a continuous casting apparatus the overall size of which both in a horizontal and in a vertical direction is small.

A further object of the invention is to provide a continuous casting apparatus in which it is not necessary to change the band each time an adjustment of the casting position is made. In this manner, in the limit, the apparatus according to the invention can enable the casting position to be adjusted without interrupting the casting itself.

The invention also proposes a continuous casting apparatus in which other secondary adjustments are also possible, such as adjustment of the position of the band pressing roller at the feed point of the metal, and the variation of the position of the cooling devices.

These and further objects evident from the following description are attained by an apparatus for continuous casting with a number of casting positions, comprising in the known manner a casting wheel, a crucible for feeding molten metal to said casting wheel, a metal band associated for a certain portion with said casting wheel, a band pressing roller at said feed point, an idle pulley for the band mounted at a distance from said casting wheel and means for cooling the casting wheel and said band, in which at least said crucible, said band pressing roller and said idle pulley for said band are mounted on a support structure hinged to the frame of the casting apparatus coaxially with the casting wheel.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics of the invention will be more evident from the following detailed description of a preferred embodiment of the invention, indicated by way of example in the accompanying drawings in which:

FIG. **1** shows the continuous casting apparatus according to the invention in the position assumed for vertical casting;

FIG. **2** is a partial section through the apparatus on a vertical plane passing through the axis of the casting wheel;

FIG. **3** is a section on an enlarged scale of the drive device for moving the hinged support structure;

FIG. **4** is a view of the adjustment unit for the band pressing roller located at the feed point of the molten metal;

FIG. **5** is a plan view of the unit shown in FIG. **4**;

FIG. **6** is a section through said unit on an enlarged scale, on a plane parallel to the axis of the casting wheel;

FIGS. **7** and **8** are diagrammatic representations of two positions assumed by the casting apparatus, the position of FIG. **8** being that corresponding to practically horizontal casting.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus for continuous casting according to the invention comprises a base frame **1** on which the casting wheel **2** is rotatably mounted, made to rotate by drive means (not shown) also mounted on the base frame **1**. The casting wheel **2** has a peripheral groove **3** and is closed in known manner through a certain arc

by the metal band **4**, which winds around the wheel **2** and the idle pulley **5**. The cooling devices, of known type, are indicated diagrammatically by the reference numerals **6** and **7**, and comprise a series of nozzles **8** for cooling the inside of the casting wheel **2** and nozzles not shown in detail for cooling the outside of the band **4**. The cooling liquid reaches the nozzles through the ducts **9** and **10** for the internal cooling and **11** for the cooling of the band, respectively.

The crucible for the molten metal is indicated by the reference numeral **12** and is provided with a feed nozzle **13** for the metal which penetrates into the zone between the band **4** and wheel **2** at the point of introduction of the metal for the casting.

The nozzle is fed through a connection with the crucible arranged coaxially with the point of hinging **15**.

The crucible **12** is slidably mounted on a cradle **16**, the cradle having a substantially semi-cylindrical development and its centre at the hinging point **15** of the nozzle support.

The cradle **16** is mounted slidably vertically on guides **18**, which are fixed in their turn to the column **19**. A gear reduction motor unit **20** is provided for moving the cradle in the vertical direction.

The column **19** supports at its upper end **22** the idle pulley **5** by means of an angle arm **21** hinged to the end **22** of the column. The angle arm **21** is hinged, at the end **23** opposite that on which the pulley **5** is idly mounted, to the mobile rod **24**, which is slidably mounted in a support cylinder **25** mounted on the column **19**. The movement of the rod **24** is attained by a screw-nut screw coupling and is controlled by the gear reduction motor unit **26** fixed to the support cylinder. It is clear that the operation of the rod **24** leads to a movement of the angle arm **21** and hence to a movement of the axis of the pulley **5**, thus being able to stretch the metal band **4** to a greater or lesser extent.

The means for cleaning the band **4**, of known type, are indicated by the reference numeral **27** and are mounted on the column **19** at **28**.

The column **19** is hinged to the base frame **1** of the continuous casting apparatus coaxially with the casting wheel **2**. In particular the lower end of the column **19** terminates in a sleeve element **29** which extends for a length slightly greater than the width of the column **19**, the sleeve element being rotatably mounted on the tubular support element **30** fixed at its ends to the base frame **1** by means of the supports **31** and **32**. The tubular support element **30** is mounted around the shaft **33** of the casting wheel, which is supported by way of the bearings **34** and **35** by the supports **31** and **32** and is rotated by drive means (not shown). Inside the shaft **33** is the duct **10** for internal cooling, as already mentioned. The sleeve element **29** is kept in position by interposing rings **38** and **39**, in order to avoid lateral movements of the column **19**.

Rigid with the column **19** is an arm **40** supporting the band pressing roller **41** disposed at the point of introduction of the liquid metal into the groove **2**. The roller **41** is mounted on the arm **40** so that it can be moved relative to this latter, by means of the member **42** hinged to the arm **40** at **43** and operated in a manner which will be described in detail hereinafter.

Rotation of the column **19** about the axis of the casting wheel **2** is made by means of the control device **45**, visible diagrammatically in FIG. **1** and in detail in FIG. **3**, which shows a section through it from above.

This control device comprises a threaded shaft **46** provided with an appendix **47**, rigid with the shaft and supported by the bearings **48** housed in the support body **49**. This is provided with seats **50** for housing pivots **51** for hinging the support lugs **52** rigidly fixed to the frame **1**. On the support body **49** is mounted the gear riduction motor unit **53** which, by way of members not shown in detail but evident, rotates the shaft **54** which is rotatably connected to the appendix **47**, and hence rotates the threaded shaft **46**.

With the threaded shaft **46** is engaged a threaded bush **55**, which in its turn is fixed to one end of the tubular element **56** which extends to the column **19** and is pivoted to this column at **57** by a pivot **58** welded to the column and passing through the appendix **59** of the tubular element **56**.

From the description it can be seen that on operation of the gear riduction motor unit **53** and the consequent rotation of the threaded shaft **46**, the bush **55** and the tubular element **56** move and hence the column **19** rotates about the axis of the casting wheel **2**. This rotation causes the simultaneous movement of the cradle carrying the crucible **12**, the arm **40** carrying the roller **41**, the band stretching pulley **5**, the band cleaning unit **27**, the header **6** for cooling the band, the extractor unit **61** and the guide **62** for the bar, i.e. all those members directly concerned with the casting.

In particular it should be noted that during rotation of the column, the crucible is maintained in the vertical position (FIGS. **7** and **8**) whereas the nozzle **13** takes different positions, as it can rotate about the point **15**.

The described adjustment permits working with an infinite number of casting positions, all equally determinable and all attainable even during a single casting operation.

The device for extracting the bar is indicated by the reference numeral **61** and the guide for the bar at the exit of the casting wheel before reaching the subsequent working station is indicated by the reference numeral **62**. These members mounted on the column **19** and suitably adjustable in position are of known type and are not further described here.

FIGS. **4**, **5** and **6** show the device for adjusting the position of the band pressing roller **41** with respect to the wheel **2** and band **4**. The roller **41** is rotatably mounted freely on the pivot **64**, which is mounted projecting in the housing **65**, welded to the hinged body **42**.

The hinged body **42** is mounted on the arm **40** by a drum **68** which can rotate at the end **69** of the arm. In particular the body **42** is pivoted to the drum **68** by the pivot **70** in an eccentric position with respect to the axis of the drum and is kept there by means of screws such as that indicated by the reference numeral **71**. The drum is provided on its peripheral surface with helical toothing **72** with which meshes a worm **73** drivable from the outside and disposed rotatably in an appendix **74** of the arm **40**. In this manner the rotation of the worm **73** enables the hinged body to assume various positions as the pivot **70** moves along the dotted line **75**, moving the roller **41** along the wheel **2**.

At the end **76** of the body **42** opposite that on which the roller **41** is mounted, there is pivoted the rod **77** of a pneumatic cylinder **44**, which is in its turn hinged to the arm **40** at **78**. An adjustment screw **79** is disposed in the body **42** near the roller **41**, and cooperates with the stop surface **80** so as to exactly establish the posi-

tion of the hinged body **42** and roller **41** with respect to the arm **40** and hence to the casting wheel.

The purpose of the pneumatic cylinder **44** is to enable the roller **41** to move for replacing the band and other similar purposes, by rotating the roller about the pivot **70** so withdrawing it from the wheel **2.**

The device for adjusting the position of the band pressing roller is particularly useful when horizontal or approximately horizontal casting is required, although this device can be used for casting in any position. For this purpose reference is made to FIGS. **1, 7** and **8.** In the first two it can be seen that the band **4** only suffers a slight deflection at the roller **41,** because of which the mechanical stresses are limited and the band is better preserved. In FIG. **8** it can be seen that the roller **41** has undergone a displacement towards the left and the band has suffered a slightly greater deflection. This is made necessary by the horizontal casting, which could not be such if the roller **41** was not made to advance. With the described device it is possible to obtain perfect adherence of the band **4** to the groove as far as the vertical passing through the axis of the wheel, hence giving perfectly horizontal casting and simultaneously leaving room for positioning the nozzle of the horizontal casting. The deflection of the band in this position is still modest, so that the band is not stressed to an undesirable extent.

From the description it can be seen that with the apparatus according to the invention it is possible to carry out casting in any position variable between the vertical and horizontal positions without having to disassemble the band, move the idle pulley **5** or apply a new band of another length each time. The additional adjustments of the position of the crucible and band pressing roller can be made in a very simple manner simultaneously with the rotation of the column **19.**

As seen from FIGS. **1, 7** and **8,** the manifold **6** of the external cooling device is rigidly fixed to the column **19,** so that this device maintains its position relative to the portion of groove covered by the band **4,** where cooling is effectively required, whatever the position of the column **19** and band **4** may be.

It can also be seen that the overall size of the apparatus according to the invention is small while giving a large range between the extreme casting positions.

The apparatus described is susceptible to modifications all of which fall within the scope of the invention. Thus different means for adjusting the band pressing roller **41** may be made or this adjustment may be associated directly with that of the column, in the sense of making the two adjustments occur simultaneously.

I claim:

1. An apparatus for continuous casting of metal, comprising a frame, a casting wheel rotatably supported by said frame, a crucible for feeding molten metal to said casting wheel, a peripheral groove in said casting wheel, a metal band covering said groove along an arc portion to define a metal receiving mold therewith, a band pressing roller arranged substantially at the point at which molten metal is fed into said groove, an idle pulley for said band arranged at a distance from said casting wheel, a support structure for said idle pulley and for said band pressing roller, and means for cooling said casting wheel and said band, wherein said support structure includes a column supporting said idle pulley at one end and hinged at the other end to said frame coaxially with said casting wheel and an arm rigid with said column for supporting said band pressing roller, and wherein said crucible is adjustably supported by said column, the apparatus further comprising means for angularly displacing said column and means for displacing said crucible with respect to said column to position said crucible in any preferred casting position along a relevant arc of said casting wheel.

2. An apparatus as claimed in claim **1,** wherein said band pressing roller is adjustably mounted on said arm, the means for adjusting said roller with respect to said arm including a drum rotatably arranged on the free end of said arm, an elongated support body rotatably supporting said band pressing roller at one end and hinged to said drum in an eccentric position, and means for rotating said drum, whereby rotation thereof causes said band pressing roller to be displaced peripherally with respect to said casting wheel.

3. An apparatus as claimed in claim **1,** in which said crucible is mounted on a substantially semi-cylindrical cradle and comprises a nozzle hinged to said crucible at a point lying substantially on the axis of said substantially semi-cylindrical cradle.

4. An apparatus as claimed in claim **3,** in which said cradle is slidably mounted on said column.

* * * * *