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(54) Method and apparatus for coupling the casting and rolling of metals

(57) The invention relates to an apparatus for the combined casting and rolling of metals comprising at least two casting lines 12, 13 and a rolling line 14 each casting line 12, 13 also comprising a corresponding receiving platform 15, 16 onto which the slab is cast which is comprised of at least two separate moveable sections 22 - 28 each of which are shorter than the length of the cast slab and which are independently moveable between a first position in which they are in line with the corresponding caster 12, 13 and a second position in which they are in line with the rolling line 14. The receiving platform 15, 16 also conveniently comprises a separate fixed section which remains fixed to each of the casting lines 12, 13. The receiving platform may comprise 2, 3, 4, 5 or a greater number of moveable sections.

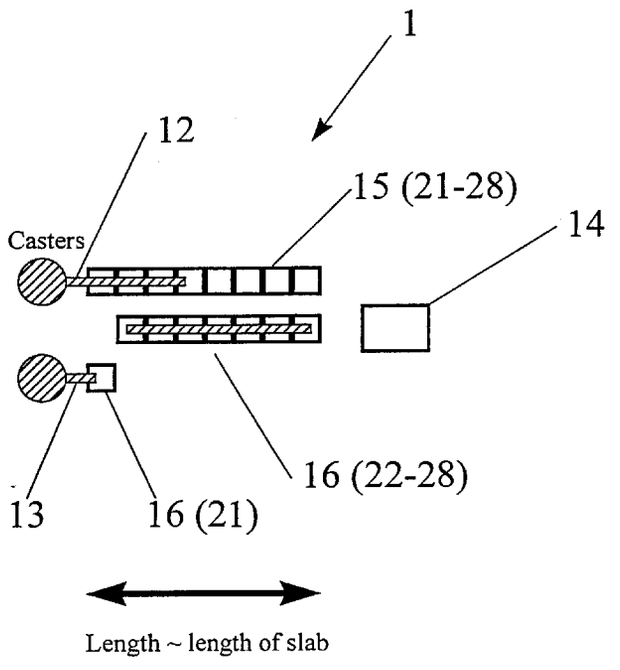

Figure 7.

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Description

The invention relates to an apparatus for coupling the casting and rolling of metals. In particular the invention relates to a combined apparatus and method for the continuous casting and then rolling of metals.

Typically in known systems more than one casting line is fed into a single rolling line because the rate of casting is normally slower than the rate through a single rolling mill line. Presently a transfer unit is used to transfer the slab which is produced by the casting line to a position in which it lines up with the subsequent rolling line. Such a conventional system is shown in figures 1 to 6 which show a conventional casting and rolling apparatus comprising two casting lines 2, 3 feeding a single rolling line 4. In figure 1 the casting process in the first casting line 2 is about half way through and the casting of the second casting line 3 is about to begin. A previously cast slab is located on the transfer unit 6 ready to enter the single rolling line 4. The next stage in the process is shown in figure 2. The casting in the first casting line 2 continues, the casting of the second casting line 3 is commenced and the previously cast slab enters the rolling line 4 from the transfer unit 6. Figure 3 shows the third stage of this conventional process in which the casting of the slab on the first casting line 2 is complete and the rolling of the previously cast slab is complete. At this point the casting of the second casting line is continuing and approaching the halfway stage. The transfer unit 6 is then moved to a position in line with the first casting line 2. As shown in figure 4 the slab being cast in casting line 2 is then cut at the required length and the slab proceeds onto the transfer unit 6. The length of the cast slab is determined by the length of the transfer unit 6 as well as the casting lines 2, 3. Referring now to figure 5 the transfer unit is translated sideways (downwardly in the drawing) to line up with the rolling line 4 so that the newly cast slab can proceed to the rolling line 4 as shown in figure 6. When the rolling of this slab is complete the second casting line 3 will have been completed and a further slab will be available. The transfer unit 6 will then move sideways to a position in line with the second casting line to receive this slab and so the procedure continues.

With such conventional apparatus the length of each cast slab is limited by the length of the transfer unit 6 and the casting line is of the same corresponding length. If slabs of greater length are required then the apparatus has to be made longer with correspondingly long casting lines and transfer units. This makes the overall length of the complete line very long and this is a major prohibiting factor. Sites for such long lengths of mills are very hard to find and expensive and existing factory sites where most new equipment is desired to be located are not long enough to accommodate such long lengths of equipment. Further more the long lengths of the casting and rolling apparatus required for long slabs are expensive in terms of the physical cost of the apparatus itself as well as the factory space it takes up.

It is therefore an objective of the invention to provide a combined casting and rolling apparatus for metal which is shorter in length than conventional casting and rolling apparatus.

It is also an objective of the present invention to provide a continuous casting and rolling apparatus which can produce longer lengths of slabs and consequently longer runs through the rolling line.

According to the invention there is provided an apparatus for the combined casting and rolling of metals comprising at least two casting lines and a rolling line each casting line also comprising a corresponding receiving platform onto which the slab is cast, characterised in that each receiving platform is comprised of at least two separate sections each of which are shorter than the length of the cast slab and which are independently moveable. The sections are preferably moveable between a first position in which they are in line with the corresponding caster and a second position in which they are in line with the rolling line.

The receiving platforms are preferably in the form of tunnel furnaces in this embodiment in which the temperature of the cast slabs can be controlled and maintained by heat retaining means and with heat adding means. They will however be referred to merely as receiving platform moveable sections henceforth in this description.

Preferably a separate section of the receiving platform remains fixed to each ofthe casting lines 12, 13.

Preferably the receiving platform comprises 2 moveable sections. Alternatively the receiving platform comprises three, four, five, six , seven or more moveable sections.

According to the invention there is also provided a method of casting and rolling of metal as carried out by the apparatus described above.

An exemplary embodiment of the method and apparatus of the invention comprising a receiving platform with seven moveable sections will now be described with the assistance of the following drawings which include drawings of a prior art apparatus already referred to and in which :

fig. 1 to 6 are schematic views of six steps of a casting and rolling method and apparatus of the prior art,

fig. 7 to 14 are schematic views of eight steps of a casting and rolling method and apparatus of the embodiment of the invention.

The method and apparatus of the prior art shown in figures 1 to 6 has already been discussed above. Referring to figures 7 to 14 the embodiment of the invention is shown in which there is provided an apparatus 1 for the combined casting and rolling of metals comprising

at least two casting lines 12, 13 and a rolling line 14, each casting line 12, 13 also comprising corresponding receiving platforms 15, 16 onto which the slab is cast. Each receiving platform 15, 16 is comprised of eight separate sections 21, 22, 23, 24, 25, 26, 27, 28 the first section 21 of which is fixed to the corresponding casting line 12, 13 and the remaining seven of which are independently moveable. The moveable sections 22 -28 are moveable between a first position in which they are in line with the corresponding casting line 12, 13 a second position in which they are in line with the rolling line 14.

Each movable section is preferably in the form of tunnel furnaces in this embodiment in which the temperature of the cast slabs can be controlled and maintained by heat retaining means and with heat adding means. They will however be referred to merely as moveable sections henceforth in this description.

Each movable section 22-28 may contain its own heat adding means but preferably, whilst each movable section will contain its own heat retaining means, only some of the movable sections will need to be provided with heat adding means. The heat adding means could be any suitable type such as by gas or electric element.

Each moveable section 22 - 28 comprises its own transverse rail (not shown) arranged between the first and second positions to precisely guide the translation movement of each moveable section 22 -28. Additionally each corresponding rail is provided with stops which stop the corresponding moveable section in precisely the desired position in-line with the corresponding casting line and the rolling line 14 respectively.

Also each of the sections comprises driven rolls for longitudinal movement of the slab from the receiving platforms 15, 16 to the rolling line 14.

Referring to each step in turn it can be seen from figure 7 that the apparatus and method of this embodiment of the invention is shown in which a first slab has already been cast and rests on the moveable sections of the second receiving platform 16 and this is ready to be fed into the rolling line 14. The first casting line 12 is part, about halfway, through the casting of a second slab on to its receiving platform 15 which is in line with the first casting line 12. The casting of a third slab on the second casting line 13 has just started on to the first fixed section 21 of its corresponding the receiving platform 16.

Referring now to figure 8 the first slab is being fed into the rolling line 14. As soon as the end of this slab leaves the first moveable section 22, this moveable section 22 is moved sideways (downwards in the figure) to its first position in-line with the second casting line to form the receiving platform for the casting of the third slab. Referring to figure 9 as the second slab leaves the next moveable section 23, this section is moved sideways (downwards in the figure) to form the receiving platform for the casting of the third slab.

Figure 10 shows this step repeated for the third and subsequent moveable sections as the first slab enters the rolling line 14. As the rolling line 14 operates at a faster speed that the casting line 12, 13 the subsequent sections build up to form the receiving platform ahead of the casting of the third slab.

Figure 11 shows the last moveable section 28 being moved sideways to complete the receiving platform for the third slab. In the meantime the casting of the second slab has been completed and as shown in figure 12 the desired length is cut and the slab is transferred to the last seven sections of the receiving platform by the drive rolls on the receiving platform sections 22 - 28.

As shown in figure 13 the second slab is transferred to the rolling line 14 by the sideways movement of all of the moveable sections 22 - 28 of the first receiving platform and the slab can then be fed into the rolling mill. The process is thus continued following this pattern on a continuous basis as shown in figure 14 with the first and subsequent moveable sections 22 - 28 of the first receiving platform moving sideways (upwards in the figure) to form the receiving platform for a fourth slab as soon as the second slab leaves the corresponding movable section 22 -28. In the meantime the casting of the third slab is continued.

It will be appreciated that by means of the invention a considerable reduction in the overall length of the production line is achieved which has considerable consequential benefit in terms of the cost of the apparatus itself and in the cost of the space required. Furthermore longer slabs are able to be cast using the method and apparatus of the invention from a mill of a given total size.

It will also be appreciated that the invention is not limited to the example described above with seven movable sections but any number may be used within the concept of the invention as defined in the appended claims.

Claims

1. An apparatus for the combined casting and rolling of metals comprising at least two casting lines 12, 13 and a rolling line 14 each casting line 12, 13 also comprising a corresponding receiving platform 15, 16 onto which the slab is cast , characterised in that each receiving platform 15, 16 is comprised of at least two separate moveable sections 22 - 28 each of which are shorter than the length of the cast slab and which are independently moveable.

2. An apparatus according to claim 1, characterised in that the moveable sections are moveable between a first position in which they are in line with the corresponding caster 12, 13 and a second position in which they are in line with the rolling line 14.

3. An apparatus according to claim 1, characterised in that the receiving platform 15, 16 also comprises a

separate fixed section which remains fixed to each of the casting lines 12, 13.

4. An apparatus according to claim 1, characterised in that the receiving platform comprises 2 moveable sections.

5. An apparatus according to claim 1, characterised in that the receiving platform comprises 3 or more moveable sections.

6. An apparatus according to claim 1, characterised in that each moveable section 22 -28 comprises its own transverse rail arranged between the first and second positions.

7. An apparatus according to claim 6, characterised in that each rail is provided with stops which stop the moveable section 22 -28 in precisely the desired position in-line with the corresponding casting line and the rolling line 14 respectively.

8. An apparatus according to claim 1, characterised in that each moveable section comprises driven rolls for longitudinal movement of the slab.

9. A method of casting and rolling of metal comprising at least one casting line and a rolling line 14 and at least one receiving platform 15,16 arranged between them, the at least one receiving platform 15, 16 comprising at least a first moveable section and at least a second moveable section, and wherein starting from a start up position casting from the first casting line 12:

the at least one receiving platform comprising corresponding first and second moveable sections of the at least one casting line is arranged in a line with the at least one casting line,

a slab is cast on the first receiving platform extending to a length greater than the length of one of the first and second moveable sections,

the receiving platform comprising the first and second moveable sections of the at least one casting line is then moved together with the slab mounted thereon to be in-line with the rolling line 4,

the slab is fed into the rolling line 4,

when the slab has left the first moveable section , the first moveable section is moved back to the casting position to receive the subsequent cast slab.

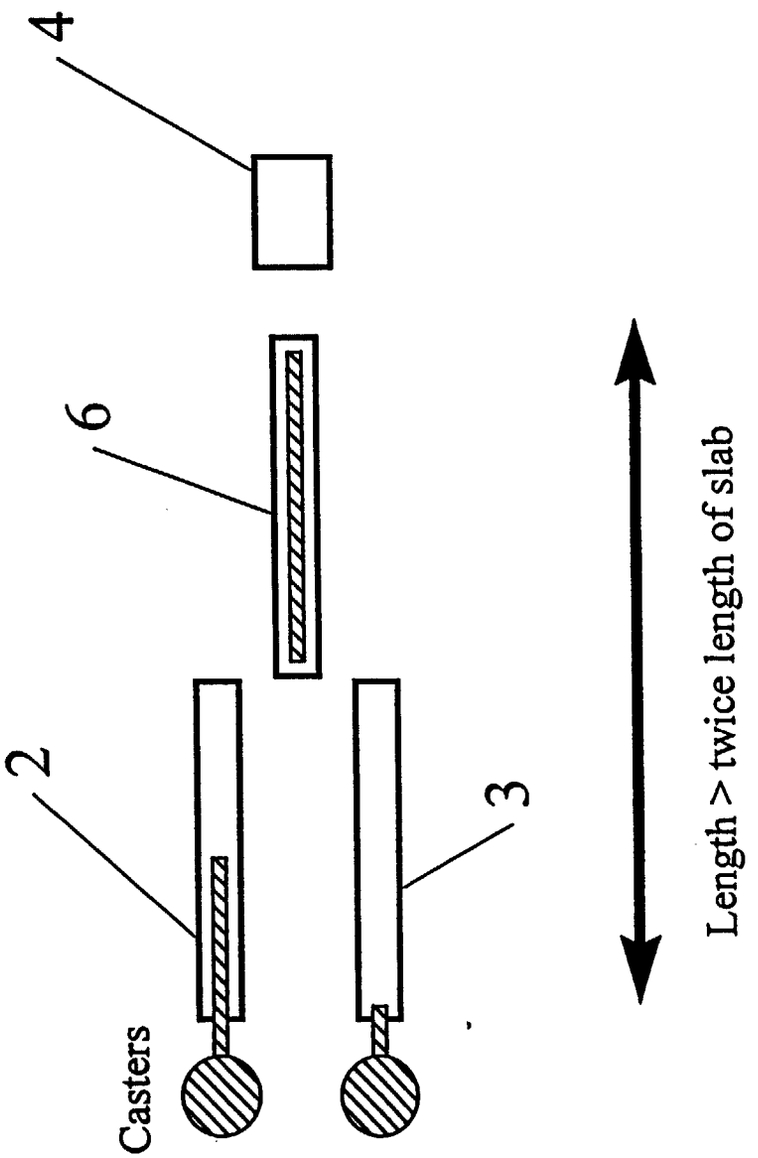

Figure 1.

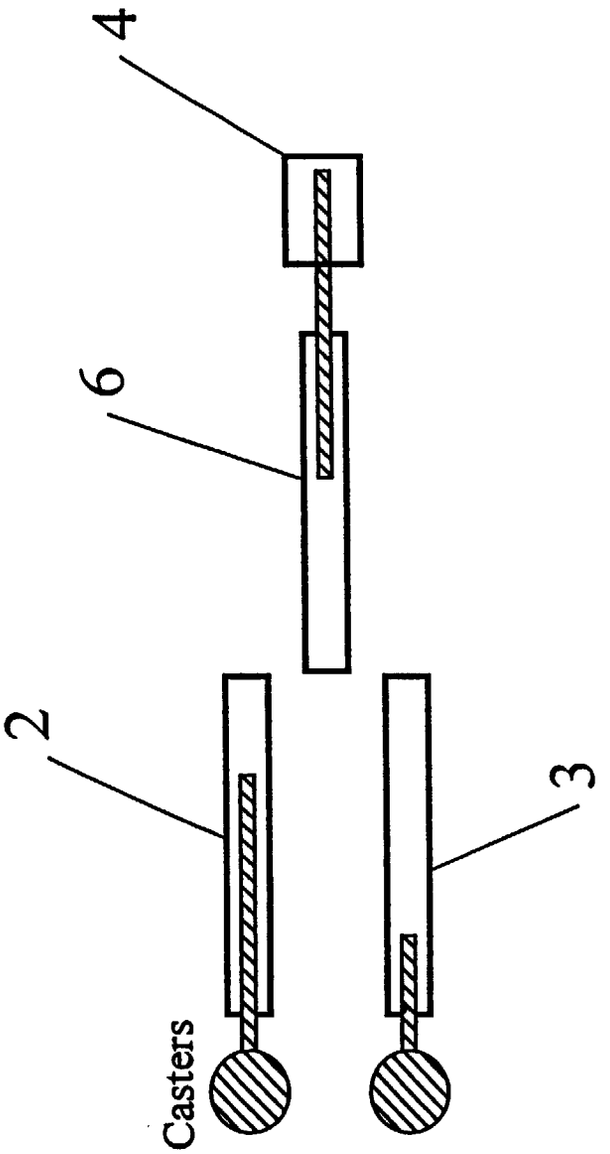

Figure 2.

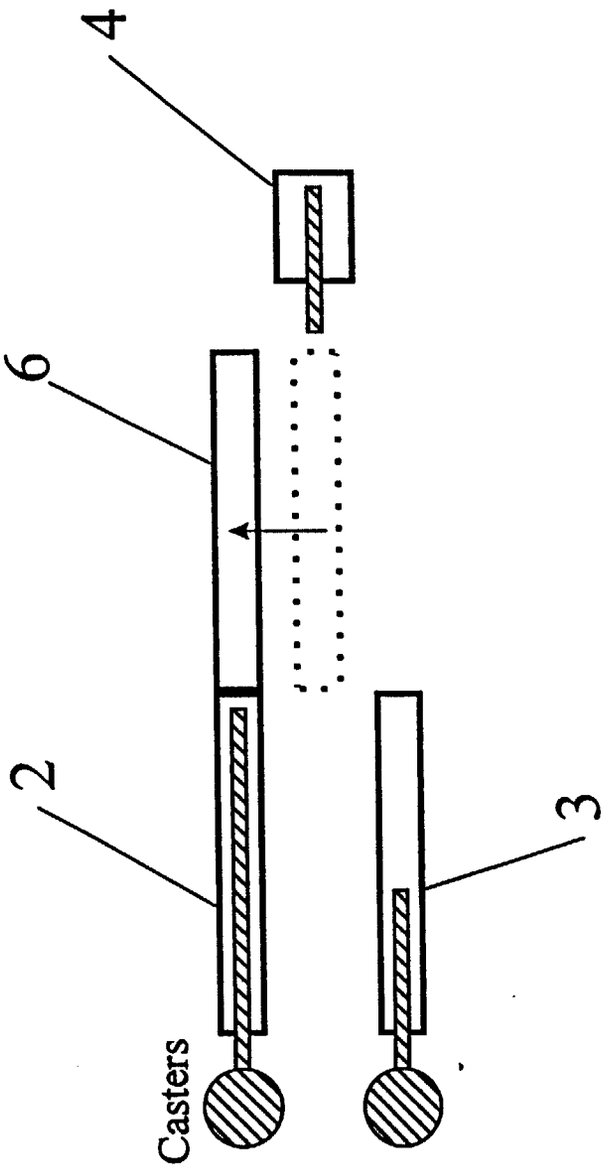

Figure 3.

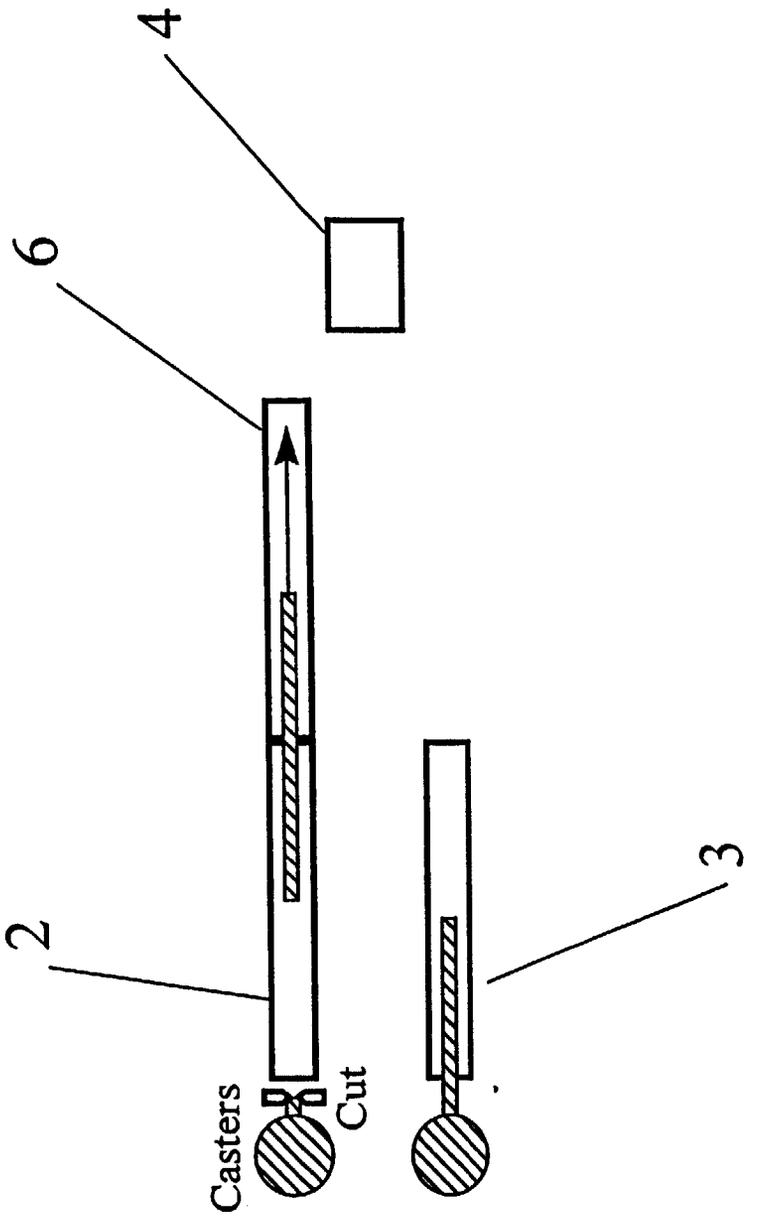

Figure 4.

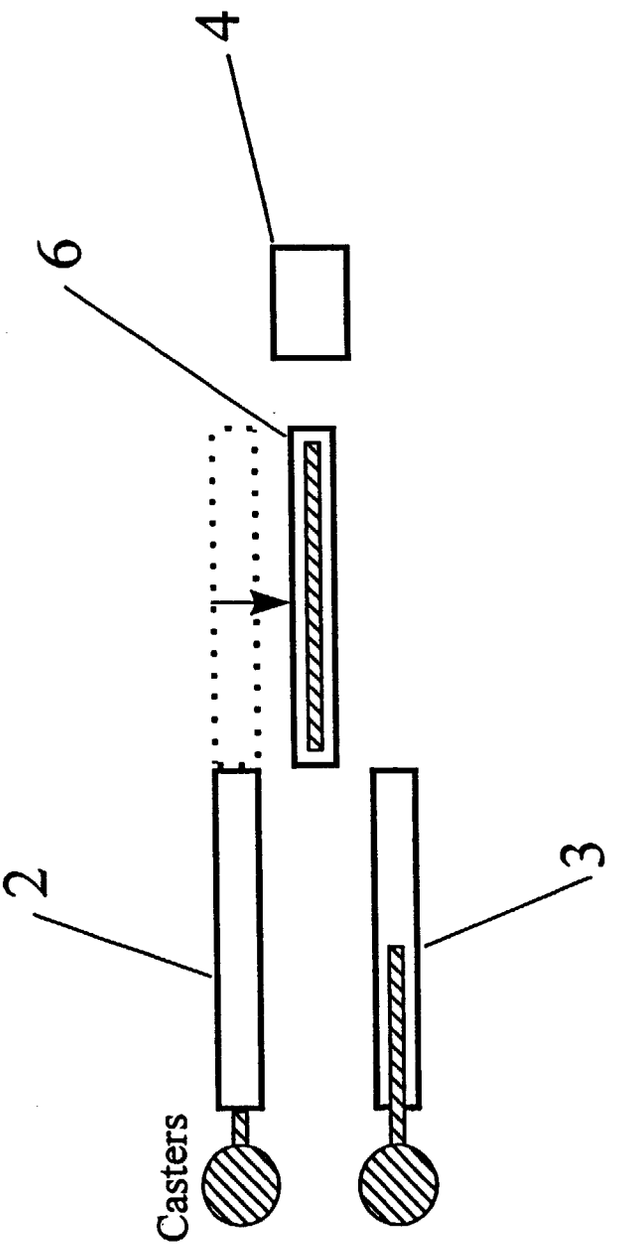

Figure 5.

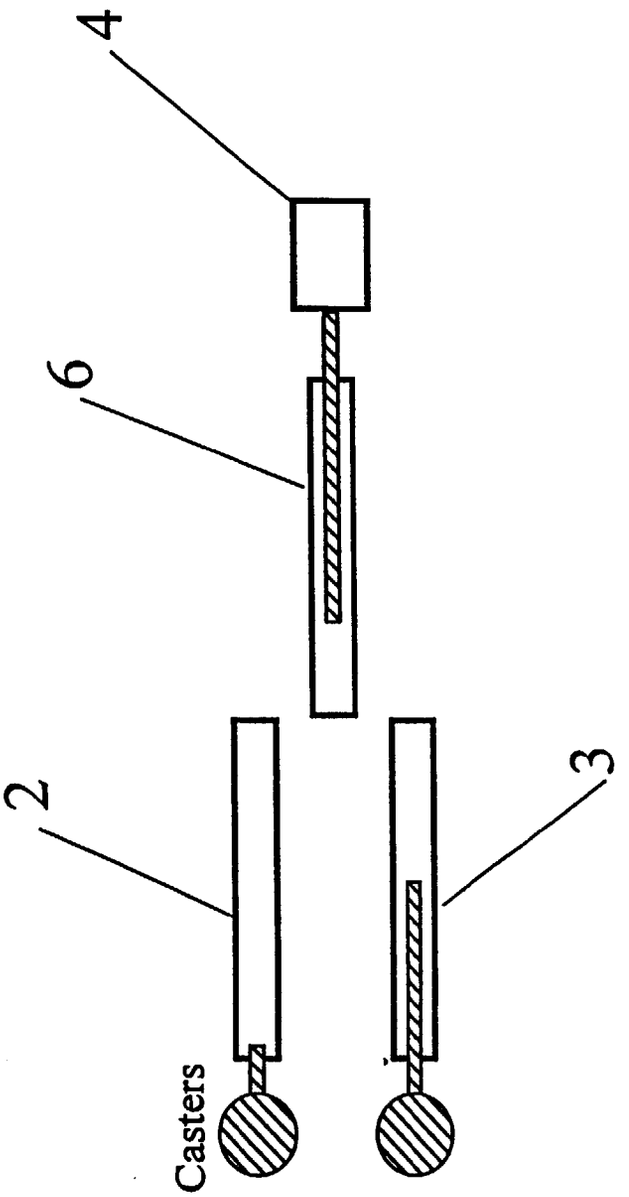

Figure 6.

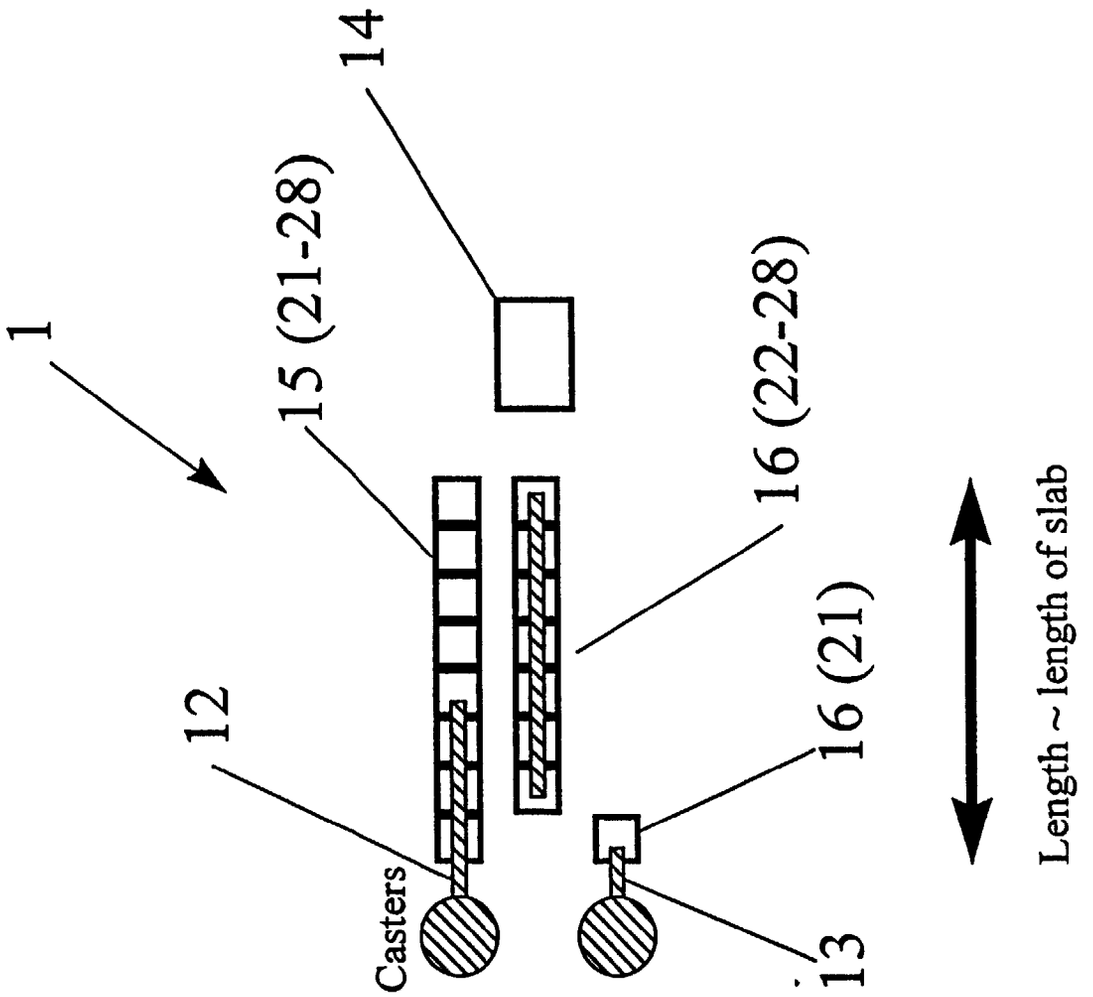

Figure 7.

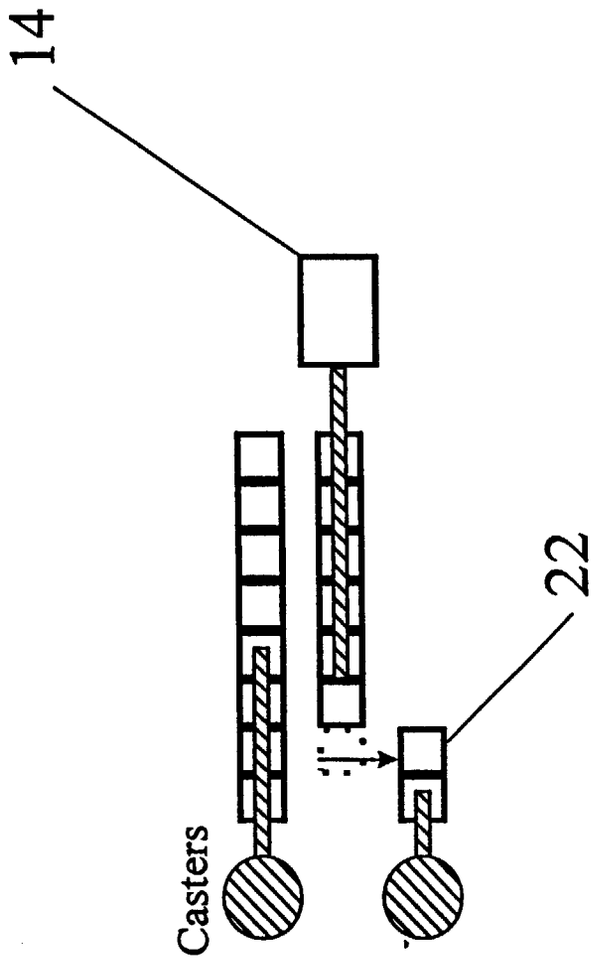

Figure 8.

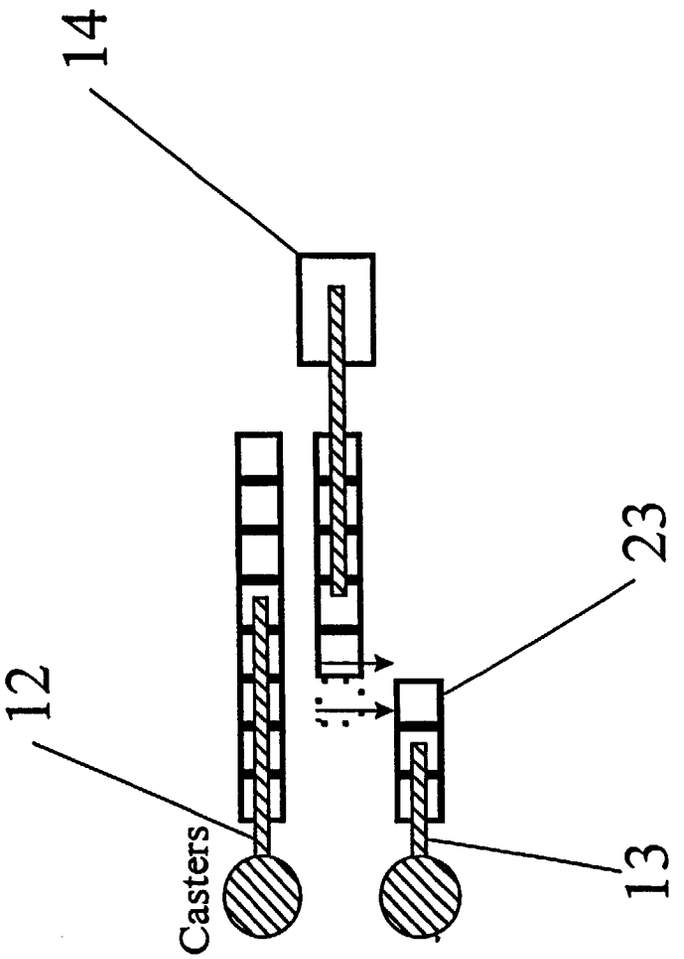

Figure 9.

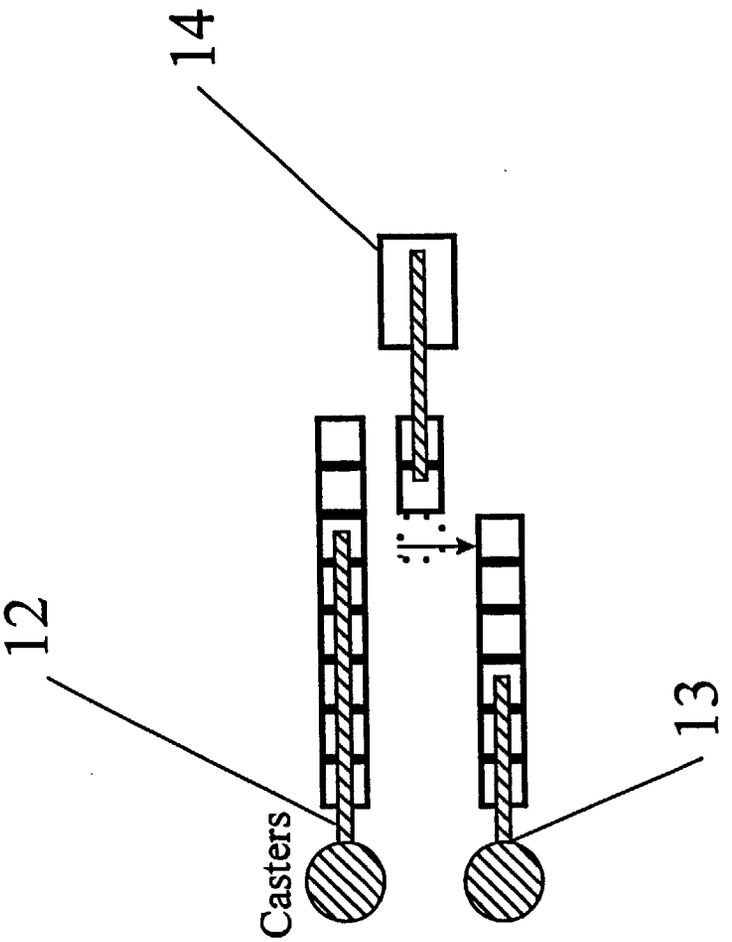

Figure 10.

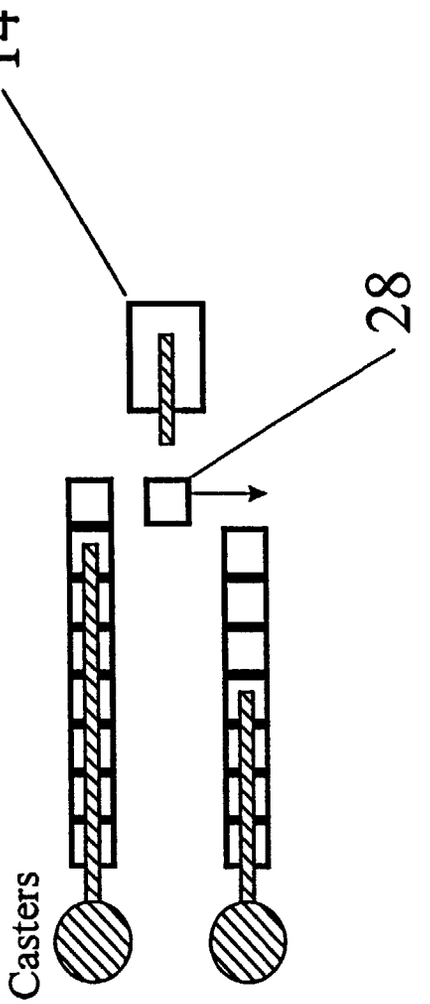

Figure 11.

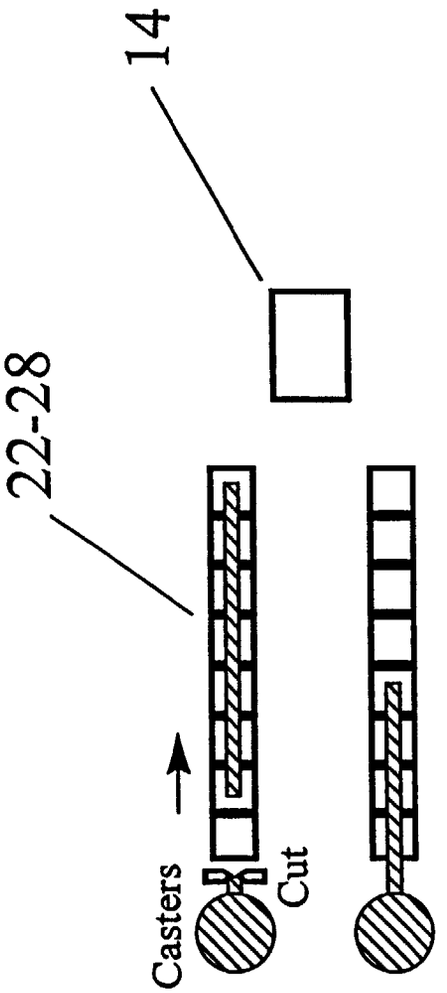

Figure 12.

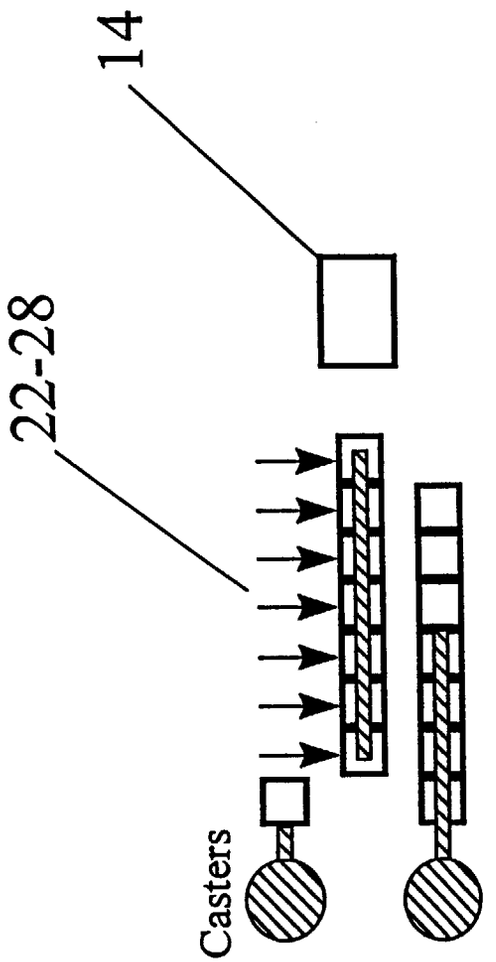

Figure 13.

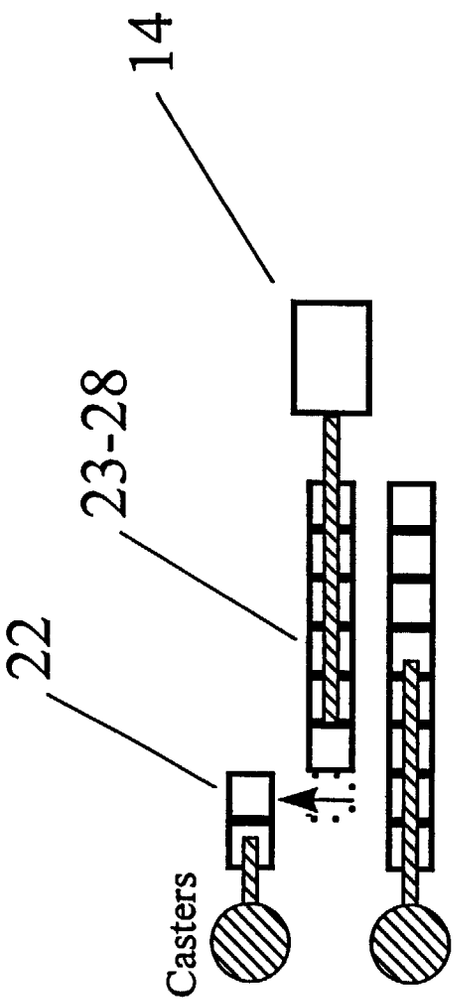

Figure 14.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 2915

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 770 433 A (DANIELI OFF MECC) 2 May 1997 * column 3 - column 4; claims 1,2,5,13,15,17,18; figure *	1,8,9	B21B1/46 B21B39/12 B21B45/00 C21D9/00 F27B9/02
A	EP 0 593 002 A (SCHLOEMANN SIEMAG AG) 20 April 1994 * column 5 - column 8; figures *	1,8,9	
A	EP 0 492 226 A (SCHLOEMANN SIEMAG AG) 1 July 1992 * column 4 - column 7; figures *	1,8,9	
A	DE 40 17 928 A (SCHLOEMANN SIEMAG AG) 12 December 1991		
A	DE 37 35 949 A (RUHRGAS AG) 3 May 1989		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B21B
C21D
F27B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 September 1998	Rosenbaum, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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