(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 264 233**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87308945.2**

(51) Int. Cl.4: **B21B 35/10** , B21B 13/08

(22) Date of filing: **09.10.87**

(30) Priority: **16.10.86 GB 8624843**

(43) Date of publication of application:
20.04.88 Bulletin 88/16

(84) Designated Contracting States:
DE ES FR GB LU

(71) Applicant: **DAVY McKEE (SHEFFIELD) LIMITED**
Prince of Wales Road
Sheffield S9 4EX Yorkshire(GB)

(72) Inventor: **Stubbins, Derek**
51, Barholm Road
Crosspool Sheffield 10 Yorkshire(GB)
Inventor: **Haynes, Ralph Gladwin**
31, School Road Laughton-en-le-Morthen
Sheffield S31 7YP Yorkshire(GB)

(74) Representative: **Kirk, Geoffrey Thomas et al**
BATCHELLOR, KIRK & EYLES 2 Pear Tree Court Farringdon Road
London EC1R 0DS(GB)

(54) Improvements in rolling mills.

(57) A rolling mill has horizontal and vertical rolls and the horizontal rolls are driven in the conventional manner. The vertical rolls have electric motors associated with them solely to rotate these rolls to a speed where their periphery matches that of the workpiece being rolled so that damage to the vertical rolls and to the workpiece is reduced when the workpiece and the rolls come into engagement.

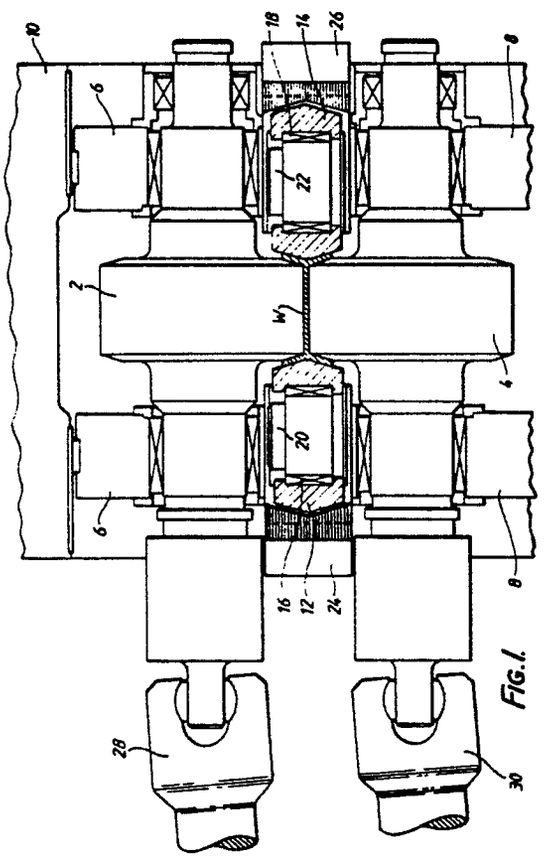

FIG.1

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IMPROVEMENTS IN ROLLING MILLS

This invention relates to rolling mills of the type having, in addition to the pair of driven rolls, a second pair of rolls which are normally only rotated by the action of a workpiece moving in the direction of its length between, and in engagement with, these rolls. Beam and section mills are mills of this type in that they have a pair of driven horizontal rolls and at least one pair of vertical rolls. The rolls constituting the or each pair of vertical rolls are positioned on opposite sides of the passline between the horizontal rolls and they are freely rotatable about their vertical axes.

One of the problems which is prevalent with this type of mill is that of the skidding which takes place between the workpiece and the vertical rolls as the workpiece enters the mill. Due to the inertia of the considerable mass of the vertical rolls, the peripheral speed of these rolls may be quite different from the linear speed of the workpiece when the workpiece engages with these rolls and this causes wear and damage to the roll surfaces and similar wear and damage to the roll bearings. This problem is even greater in the case of a reversing mill where the workpiece enters the mill from one side, passes between the rolls and comes to rest on a run-out table on the opposite side. The gaps between the pairs of rolls are reduced and the workpiece is then reversed back between the pairs of rolls to the first side of the mill. It is found that, as the workpiece leaves the mill, the vertical rolls, being unconnected to any drive means, continue to rotate and, when the workpiece then enters the mill from the other side, the vertical rolls are still rotating but in the "wrong direction" and a very great deal of slip and skidding takes place as the workpiece causes the rolls to be first decelerated to standstill and then accelerated in the opposite direction of rotation to a speed equal to the linear speed of the workpiece.

The present invention resides broadly in a rolling mill of the type set forth in which each of the normally non-driven rolls has a separate electric motor means associated with it by which the roll can be rotated so that when the workpiece and the roll come into engagement the engaging surfaces of the roll and workpiece are moving in the same direction.

With such an arrangement it is not the intention for the electric motor means to rotate the rolls while the workpiece is passing through the mill between the rolls but simply to adjust the direction of rotation of the rolls and preferably the speed also so that they are substantially matched when the workpiece engages with the rolls.

In order that the invention may be more readily understood, it will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a view, partly in section, of a universal rolling mill according to the present invention;

Figure 2 is a section through a vertical roll of the mill and its associated roll chock in accordance with one embodiment of the invention;

Figure 3 is a section through a vertical roll of the mill and its associated roll chock in accordance with a second embodiment of the invention; and

Figure 4 is a perspective view of electric motor means shown in Figures 1, 2 and 3.

Referring to Figure 1, a universal rolling mill comprises a pair of horizontal rolls 2, 4 each having roll necks rotatable in bearings in bearing chock assemblies [chocks] 6, 8, respectively. The chocks are arranged in a mill housing strucutre 10. A pair of vertical rolls 12, 14 are freely rotatable on bearings 16, 18 which surround a pair of stationary shafts 20, 22 mounted in bearing chock assemblies [chocks] 24, 26, respectively.

The horizontal rolls are driven by electric motors (not shown) by way of drive shafts 28, 30 but the vertical rolls 12, 14 are normally undriven and rely on the movement of the workpiece between the vertical rolls and in engagement therewith to cause the rolls to rotate.

In the present invention, however, each of the chocks 24, 26. which are associated with the vertical rolls has electric motor means associated with it. In the arrangement shown each chock has two or more recesses 32, 34, 36 in which are located electric motors of the linear type, indicated by references 38, 40, 42. These motors consist of stationary windings which, when energised, interact with the metal of the adjacent roll 12, 14, to cause it to rotate. Motors of this type are available from Linear Motors Limited, Empress Road, Loughborough, England. Excitation of the motors applies a turning force to the rolls sufficient to cause them to rotate or, if they are rotating in the opposite direction, to have a braking and then reversing effect on these rolls.

During a rolling operation a workpiece W is passed between the pairs of rolls causing the vertical rolls to rotate such that the peripheral speed of the vertical rolls matches the linear speed of the workpiece. As the tail end of the workpiece emerges from the rolls, the vertical rolls continue to rotate about their vertical axes. The workpiece is halted on a run-out table (not shown) on the opposite side of the mill and the drive to the horizon-

tal rolls is reversed and then the driven rolls of the run-out table are reversed to feed the workpiece back into the mill. In order to ensure that minimum slippage occurs between the workpiece and the vertical rolls, the linear motors are actuated to impart a turning force on the vertical rolls in a direction opposite to that in which they are rotating. This has an initial braking effect on the rolls and, having brought the rolls to standstill, causes them to rotate in the opposite direction of rotation corresponding to the direction of travel of the workpiece now re-entering the mill. The linear motors are controlled so that, when the workpiece reenters the mill, at least the rolls are rotating in the correct direction and preferably the peripheral speed of the vertical rolls is substantially matched to the linear speed of the entering workpiece.

In the arrangement shown in Figure 2, each vertical roll 12, 14 has three motors 38, 40, 42 associated with it whereas in the Figure 3 arrangement only two motors 38, 42 are employed. Each motor is conveniently of the form shown in Figure 4 in which a housing 50 carries the windings on an arcuate stator. The stator has terminals 44 in a terminal box 46 and passages 48, 52 enable a cooling fluid to be circulated through the stator housing.

The pair of vertical rolls may have their longitudinal axes in the same vertical plane which contains the longitudinal axes of the horizontal rolls. Alternatively, the mill may have one pair of vertical rolls arranged with their longitudinal axes in a vertical plane parallel with that containing the longitudinal axes of the horizontal rolls. Furthermore two pairs of vertical rolls may be provided and located upstream and downstream respectively of the horizontal rolls.

Claims

1. A rolling mill for rolling a metal workpiece (W), said mill comprising a housing structure (10);
a first pair of rolls (2, 4) for rolling the workpiece said rolls being arranged with their longitudinal axes parallel and rotatably mounted in bearing chock assemblies (6) located in the housing structure;
drive means (28) connected to said first pair of rolls to rotate the rolls so as to roll the workpiece therebetween;
a second pair of rolls (12, 14) for rolling the workpiece therebetween, said rolls being arranged with their longitudinal axes parallel and substantially normal to those of the first pair of rolls; each of the rolls of said second pair being rotatably mounted in a separate bearing chock assembly (24, 26) mounted in the housing structure and characterised in that each of the rolls (12, 14) of the second pair has electric motor means (38, 40, 42) associated with the bearing chock assembly to rotate the roll so that when the roll and the workpiece come into engagement the engaging surfaces of the roll and workpiece are moving in the same direction.

2. A rolling mill as claimed in claim 1, characterised in that the electric motor means is mounted in the bearing chock assembly (24, 26).

3. A rolling mill as claimed in claim 2 characterised in that the electric motor means (38, 40, 42) comprises at least one electric motor having stationary windings mounted in the bearing chock assembly and which, when energised, co-act with the roll (12, 14) to apply a turning force thereto.

4. A rolling mill as claimed in claim 1, 2 or 3 characterised in that each of the rolls of the second pair is of annular form and is rotatably mounted on a fixed shaft (20, 22) forming part of the bearing chock assembly.

5. A rolling mill as claimed in any preceding claim characterised in that the first pair of rolls are arranged with their longitudinal axes horizontal and the second pair of rolls (12, 14) are arranged with their longitudinal axes vertical.

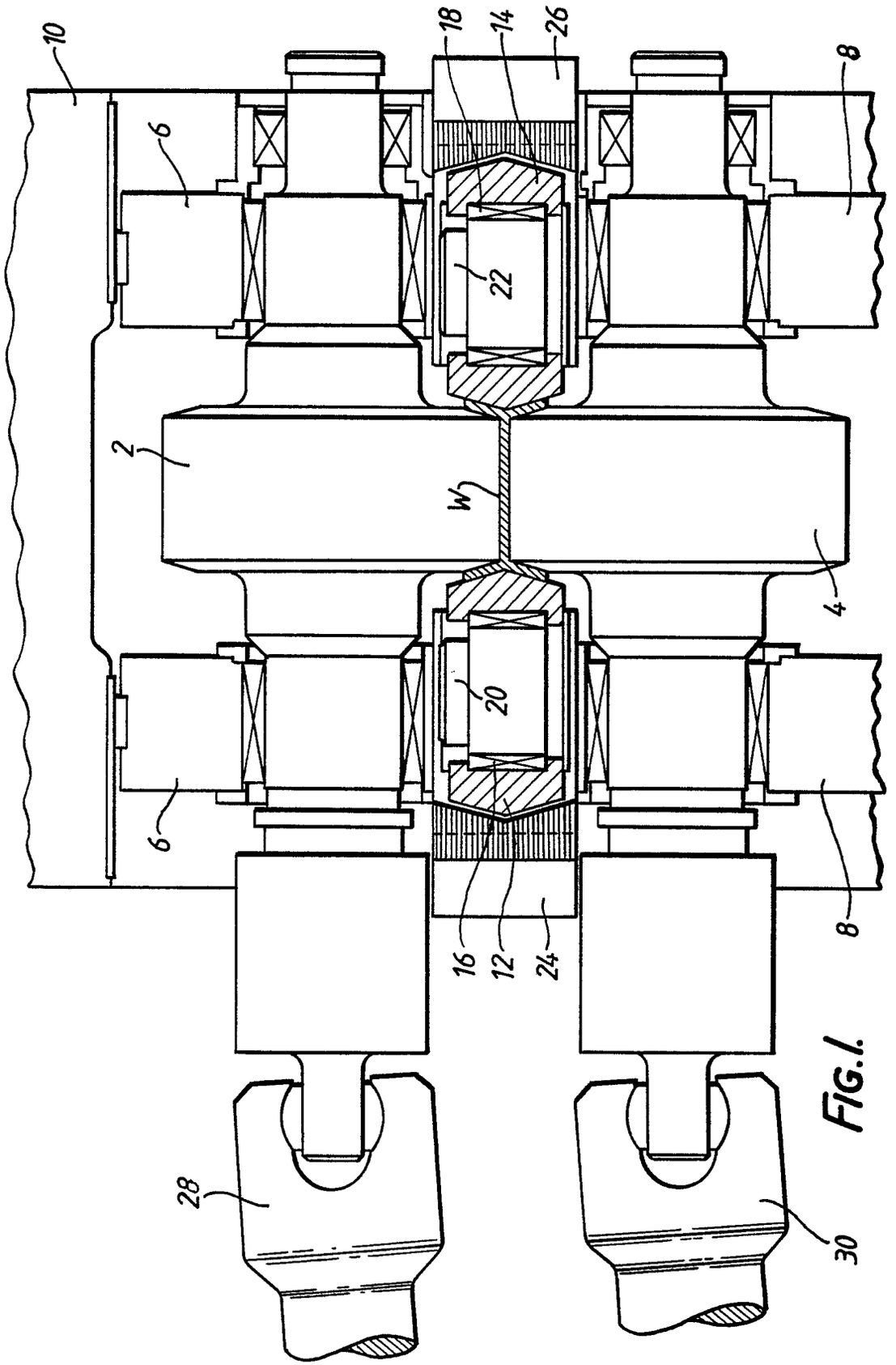

FIG.1

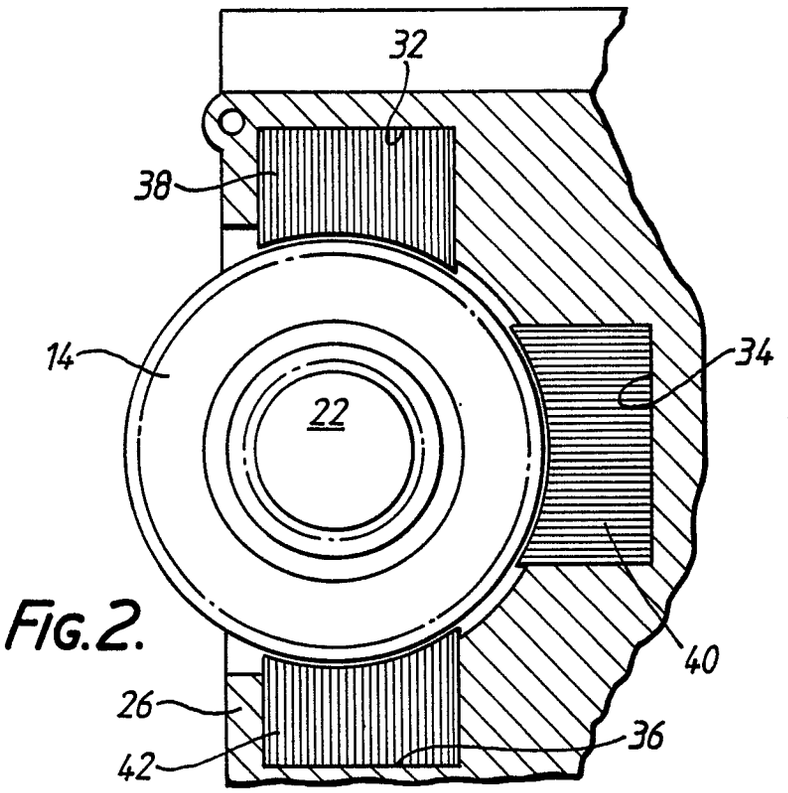

FIG. 2.

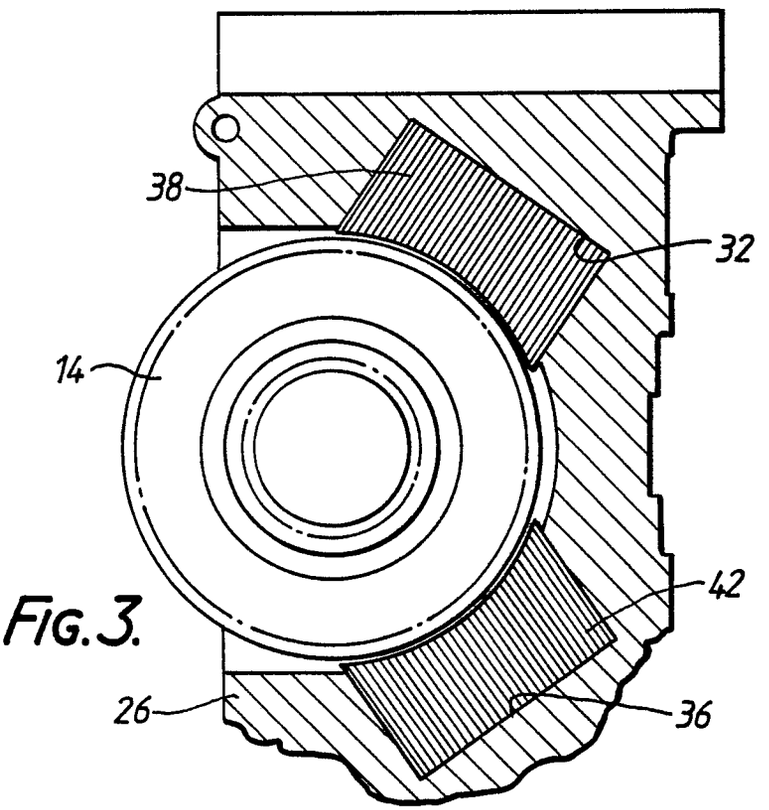

FIG. 3.

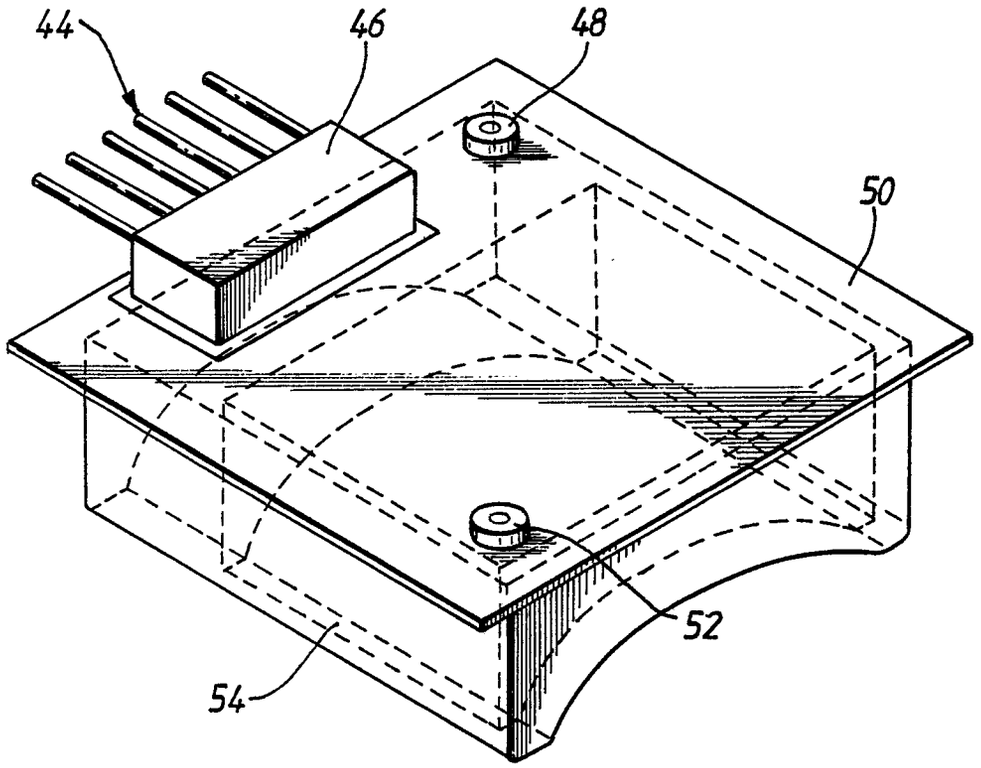

FIG.4.