



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 962 265 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.12.1999 Bulletin 1999/49

(51) Int. Cl.⁶: **B21B 31/02**

(21) Application number: **99107241.4**

(22) Date of filing: **14.04.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **05.06.1998 GB 9812067**

(71) Applicant:
**Kvaerner Technology & Research Limited
Sheffield S9 4EX (GB)**

(72) Inventors:
• **Beagles, Adam Edward**
Sheffield, South Yorkshire S10 5PG (GB)
• **Hetherington, Adrian**
Worksop, Northamptonshire S81 8JB (GB)

(74) Representative:
Harman, Michael Godfrey
Hillgate Patent Services,
No. 6 Aztec Row,
Berners Road
Islington, London N1 0PW (GB)

(54) Mill housings

(57) A mill frame having a pair of vertical mill posts 10' and 11' joined at their ends by horizontal posts 12' and 13'. In the present frame, the posts are curved outwardly at their ends (e.g. 30) where they join the beams. A substantial portion of the bending resulting from the bending forces in the beams thereby occurs in the curved end regions of the posts. The beams are narrowed towards their ends.

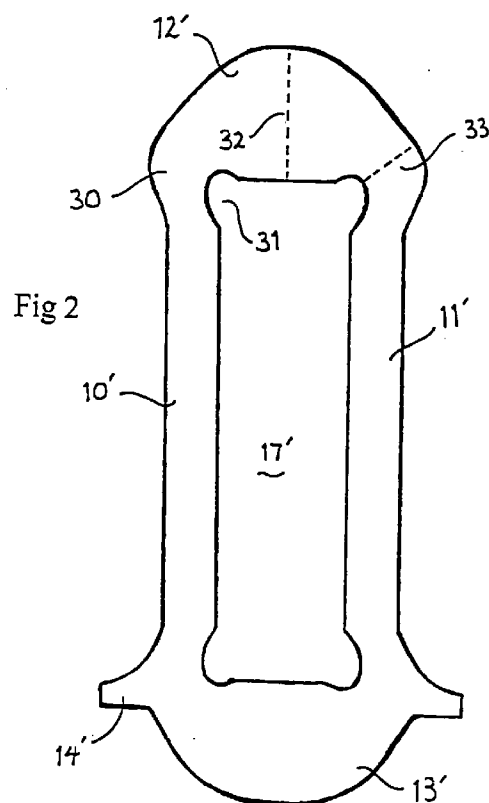


Fig 2

EP 0 962 265 A1

Description

[0001] The present invention relates to rolling mill housings, and more specifically to mill frames.

[0002] A rolling mill for steel and similar materials consists essentially of a pair of rolls (primary rolls) between which the strip of material to be rolled is passed. The two primary rolls are pressed together to squeeze the strip being rolled and so reduce its thickness. The compression force may be applied directly to these two rolls via their axles, or there may be backing rolls mounted outside the primary rolls to apply the required force to them. The various rolls are typically arranged in a vertical column, with their axes horizontal.

[0003] The rolls are mounted in a mill housing, which comprises a pair of vertical mill frames. Each mill frame is a single integral structure consisting broadly of a pair of vertical posts joined at the top and bottom by horizontal beams, so forming a vertical window. The axles of the various rolls pass through this window, and are mounted therein by means of suitable bearings. Means for exerting the required forces on the axles, and hence on the rolls, are also provided at or adjacent to the mill frames.

[0004] The compression forces on the rolls are applied between the axles of the rolls and the ends of the windows of the mill frames. More specifically, these forces are applied at substantially the middles of the beams of the mill frames. This results in distortion of the mill frames; with the beam portions of the frames tending to bow outwardly. The resulting bending forces at the ends of the mill frame beams are transmitted, at the corners of the mill frames, to the posts, which therefore tend to bow inwardly.

[0005] This distortion of the mill frames is undesirable, as it changes the geometry of the mill. Further, the mountings of the mill rolls in the windows of the mill frames have to be able to move vertically. The changing widths of the windows in the mill frames mean that the mountings have to be designed to move at the minimum window width, and the mountings will therefore have undesirable horizontal play when the window is not at its greatest constriction.

[0006] The object of the present invention is to alleviate these problems.

[0007] According to its main feature, the present invention provides a mill frame having a pair of vertical mill posts joined at their ends by horizontal beams, wherein the posts are curved outwardly at their ends where they join the beams, such that a substantial portion of the bending resulting from the bending forces in the beams occurs in the curved end regions of the posts. Preferably the beams are narrowed towards their ends.

[0008] A mill frame in accordance with the invention will now be described, by way of example, with reference to the drawings, in which:

Fig. 1 is an end view of a known mill frame;

Fig. 2 is an end view of the present mill frame;

Figs. 3A and 3B are diagrams illustrating the mill frame window of the known mill frame in the unstressed and stressed conditions; and

Figs. 4A and 4B are diagrams illustrating the mill frame window of the present mill frame in the unstressed and stressed conditions.

[0009] Fig. 1 shows a known mill frame consisting of two vertical posts 10 and 11 joined by a top beam 12 and a bottom beam 13. The posts 10 and 11 have formed on them lugs 14 for mounting the mill frame and lugs 15 and 16 on which roll bearings and other ancillary devices may be mounted; these lugs are not relevant for present purposes. The posts and arms 10-13 define a substantially rectangular mill frame window 17 in which the bearings (not shown) of the various mill rolls are located.

[0010] Fig. 3A shows diagrammatically the window 17 of this mill frame in the unstressed condition; the window is essentially a rectangle in this condition. Fig. 3B shows the same window in the stressed condition. The primary stress is against the centres of the inner sides of the beams 12 and 13, as indicated by the arrow 20 (the forces at the bottom of the window are similar). The upper beam is attached to (and in fact integral with) the posts 10 and 11 at its ends, so this force 20 produces a bowing upwards of the beam and turning forces 21 in the beam as shown. These turning forces are transmitted past the inner corners 22 of the window 17 to the upper ends of the posts 10 and 11 and produce corresponding rotations 23 at the tops of the posts. The result of these forces (and the corresponding forces at the bottom of the frame) is a bowing inwards of the window 17, as indicated by the arrows 24.

[0011] In practice, of course, known mill frames may be more elaborate than the simple form shown here, with, for example, various radii, chamfers, and undercuts at the outer corners of the frame where the horizontal beams join the vertical posts, and at the inner corners of the window. However, none of these variations and elaborations significantly affects the response of the frame to applied forces as just discussed.

[0012] Fig. 2 shows the present mill frame; parts corresponding to the mill frame of Fig. 1 are shown with corresponding references but distinguished by primes. There are two major differences from the known mill frame of Fig. 1.

[0013] First, the posts 10' and 11' are curved outwardly at their ends where they meet, as shown at the upper end 30 of post 10'. This results in an outward bulge 31 at the top corner of the window 17' (and, of course, corresponding bulges at the other corners). As shown, the bulge 31 is preferably rounded and preferably extends slightly above the bottom edge line of the main portion of the beam 12' as well as beyond the inside vertical edge line of the main portion of the post

10'. The posts 10' and 11' thus effectively have beam-like curved sections at their upper and lower ends where they meet the cross beams 12' and 13'.

[0014] Second, the upper edge of the beam 12' is curved, so that this beam is thicker at its centre, as indicated at 32, than it is at its ends, as indicated at 33. 5

[0015] Fig. 4A shows diagrammatically the window 17' of this mill frame in the unstressed condition; in this condition the window is essentially a rectangle with bulges 31 (here shown diagrammatically) at its corners. Fig. 4B 10 shows the same window in the stressed condition. The primary stress is against the centres of the inner sides of the beams 12' and 13', as indicated by the arrows 20'. The upper beam is held at its ends, so this force 20' produces a bowing upwards of the beam and turning forces 15 21' in the beam as shown (the forces at the bottom of the window are similar). These turning forces are transmitted past the inner corner bulges 31 of the window 17' to the upper ends of the posts 10' and 11' to produce counter-rotational forces 35 at the tops of the posts, as 20 shown. As a result, there is very little rotation of the posts in the regions 36, and the width of the middle of the window, indicated at 37, undergoes very little change.

25

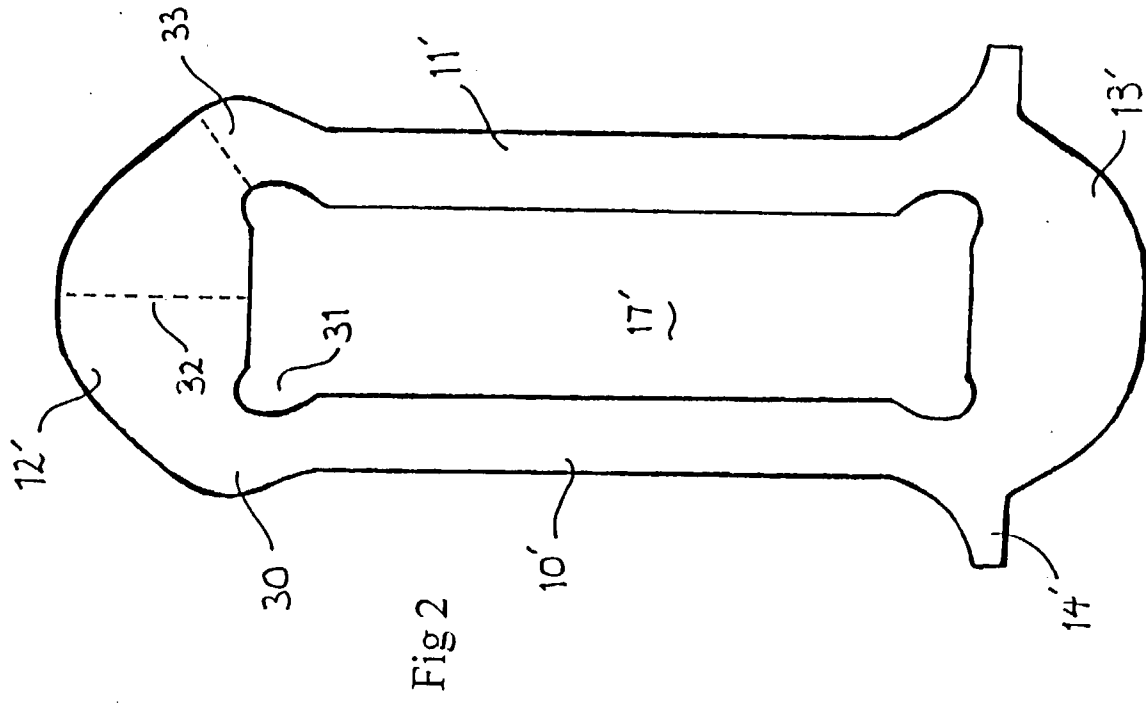
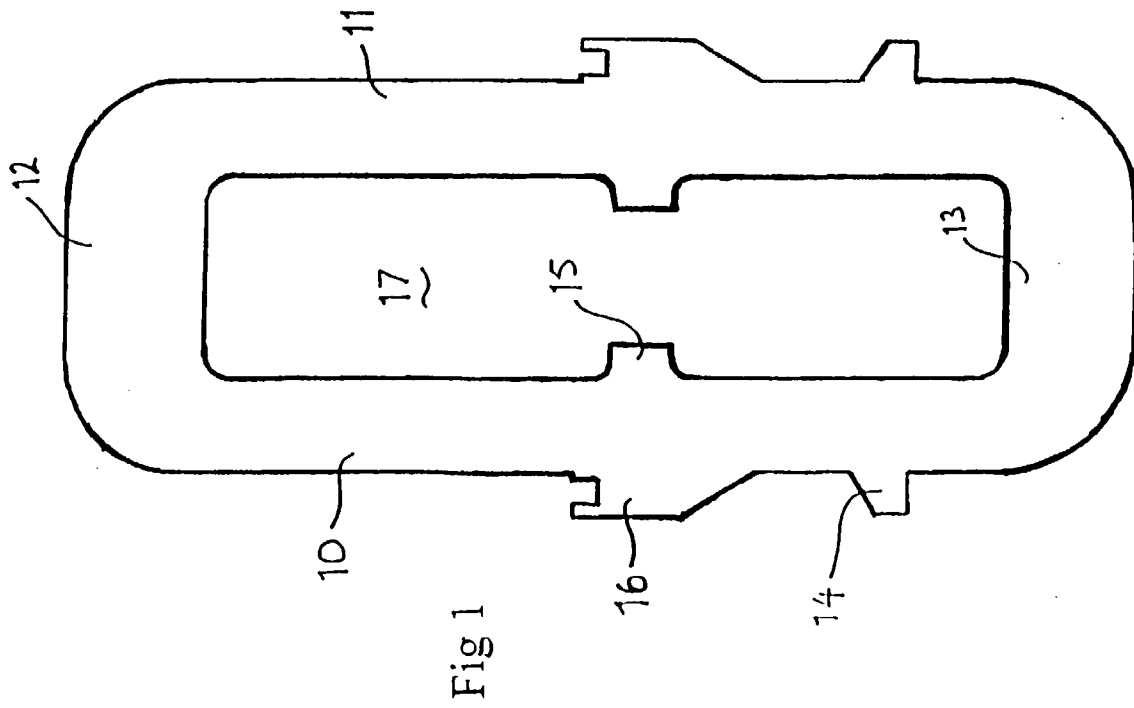
Claims

1. A mill frame having a pair of vertical mill posts (10', 11') joined at their ends by horizontal beams (12', 13'), wherein the posts are curved outwardly at their 30 ends (30) where they join the beams, such that a substantial portion of the bending resulting from the bending forces in the beams occurs in the curved end regions of the posts.
2. A mill frame according to claim 1 wherein the 35 beams are narrowed towards their ends (32 to 33).
3. Any feature of novelty or combination thereof within the meaning of Article 5 of the International Con- 40 vention (Paris Convention).

45

50

55



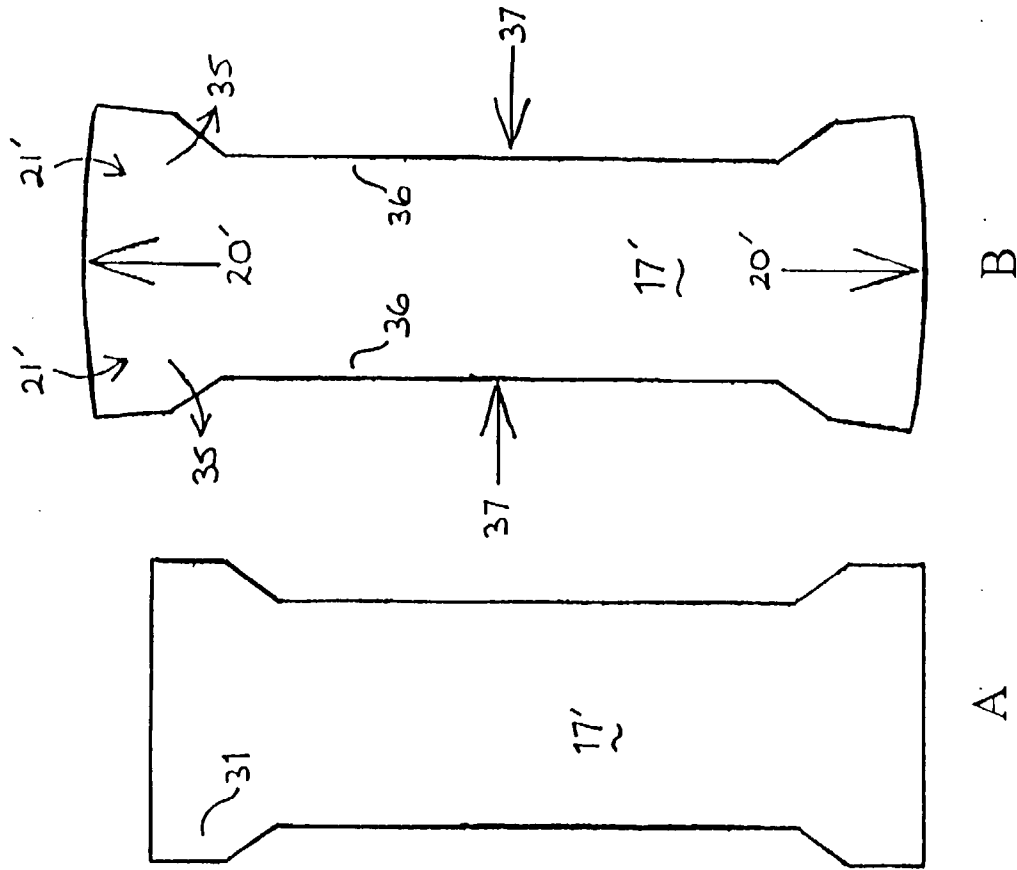


Fig 4

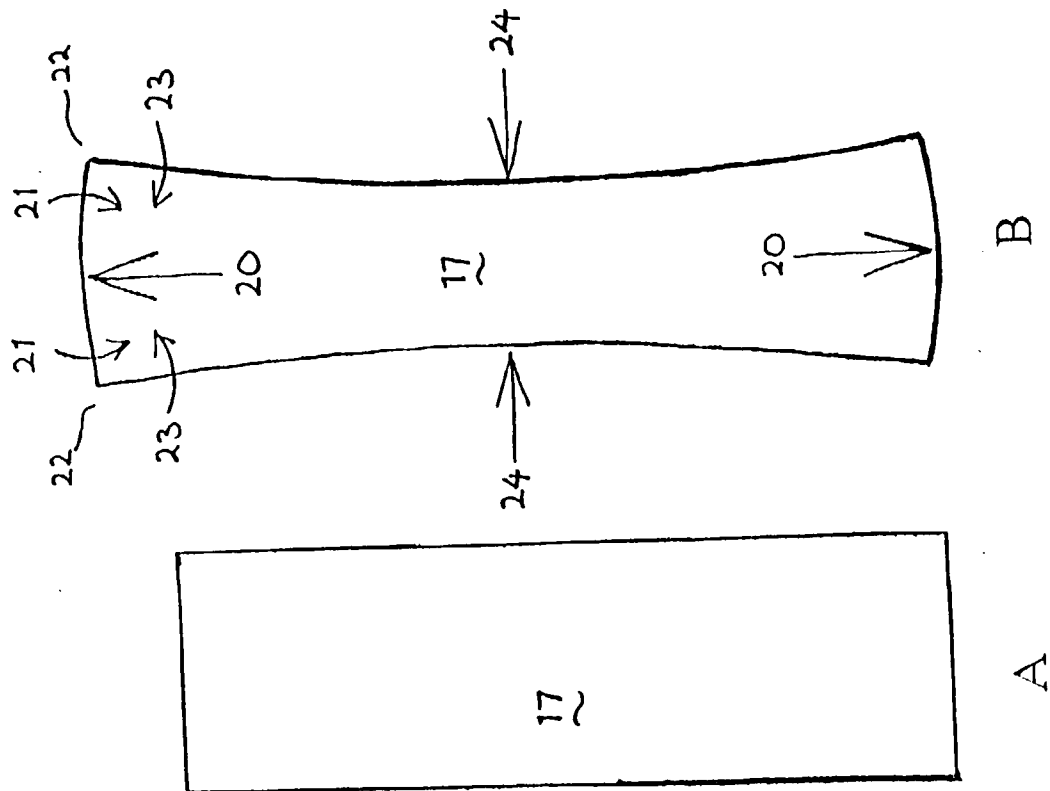


Fig 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 7241

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	DE 195 06 873 C (MANNESSMANN AG) 4 July 1996 (1996-07-04) * column 4; figure 3 * ---	1, 3	B21B31/02
A	DE 703 735 C (SKUBALLA EMIL) 14 March 1941 (1941-03-14) * the whole document * ---	1-3	
A	US 2 064 352 A (MESSINGER WILLIAM) 15 December 1936 (1936-12-15) * page 2; figure 1 * ---	1-3	
A	DE 44 34 797 A (SMS SCHLOEMANN SIEMAG AG) 4 April 1996 (1996-04-04) * column 2; figure 3 * -----	1, 3	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B21B
Place of search		Date of completion of the search	Examiner
THE HAGUE		21 September 1999	Rosenbaum, H
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P4C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 10 7241

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-09-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19506873 C	04-07-1996	AU 2521395 A	04-09-1996
		CZ 9702446 A	17-03-1999
		WO 9625250 A	22-08-1996
		DE 59505541 D	06-05-1999
		EP 0809546 A	03-12-1997
		ES 2129824 T	16-06-1999
		JP 8215723 A	27-08-1996
		PL 321828 A	22-12-1997
		SI 9520152 A	31-12-1997
		US 5839314 A	24-11-1998
DE 703735 C		NONE	
US 2064352 A	15-12-1936	NONE	
DE 4434797 A	04-04-1996	NONE	