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(71) Applicant: **VSESOJUZNY ZAOCHNY POLITEKHNICHESKY INSTITUT**
ul. Pavla Korchagina, 22
Moscow, 129805(SU)

(72) Inventor: **MOSKVITIN, Sergei Alexandrovich**
ul. Gorkogo, 78-6
Belgorod, 308000(SU)
Inventor: **PLAKHTIN, Vladimir Dmitrievich**
ul. 16 Parkovaya, 55-1-95
Moscow, 105523(SU)
Inventor: **DANILOV, Leonid Ivanovich**
ul. Vereschagina, 51-8 Vologodskaya obl.
Cherepovets, 162606(SU)
Inventor: **KANEV, Nikolai Galaktionovich**
ul. Arkhangelskaya, 62-143
Vologodskaya obl. Cherepovets, 162601(SU)
Inventor: **SOROKIN, Alexandr Mikhailovich**
pr. Pobedy, 206-13 Vologodskaya obl.
Cherepovets, 162624(SU)

(74) Representative: **Simpson, Ronald Duncan Innes et al**
A.A.Thornton & Co. Northumberland House
303-306 High Holborn
London WCIV 7LE(GB)

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(54) **ROLL STAND OF ROLLING MILL.**

(57) The roll stand of a rolling mill comprises frames (1), in which are mounted pillows (2, 4) of the upper and the lower driving roller (3, 5) together with their bearing assemblies (11), the pillows (4) of the lower driving roller (5) being provided on both sides of the vertical axis (6) of the stand with hollows in which are mounted the hydraulic cylinders (7, 8) of a counterbalancing device, whose rods (9, 10) co-operate with the pillows (2) of the upper driving roller (3). The rods (10) of the hydraulic cylinders (8) located on one side of the vertical axis (6) of the stand have a total cross-sectional area which is 1.05

- 3.00 times larger than that of the rods (9) of the hydraulic cylinders (7) located on the other side of the vertical axis (6) of the stand.

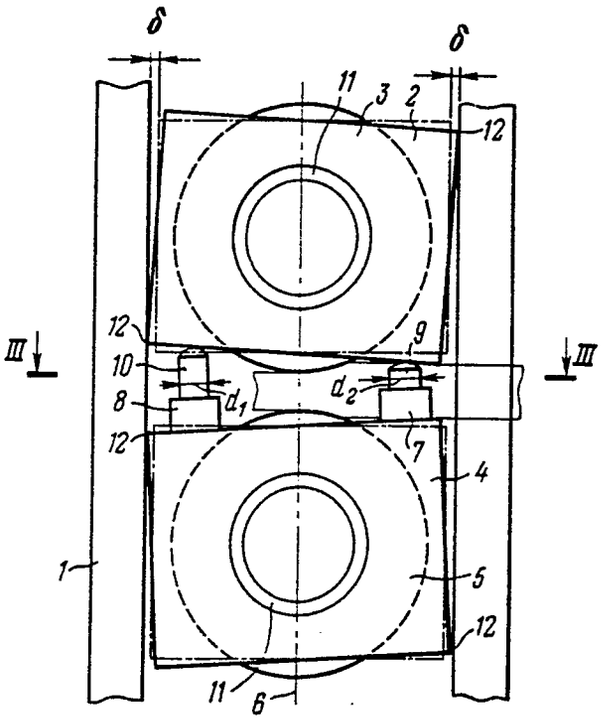

FIG.2

WORKING STAND OF ROLLING MILL

Field of the Art

The present invention relates to rolling practice and, more specifically, to the working stand of a rolling mill.

Prior Art

At present, the side clearances existing between the roll chocks and the stand housings are the reason for a rather low quality of rolled stock and service life of the bearing assemblies of the work rolls. When the rolled metal is bitten by the rolls, said rolls are apt to move longitudinally in the zone of said clearances. These movements impose heavy impact loads on the bearing assemblies of the rolls which causes their ultimate failure.

Besides, these movements redistribute the rolling torques on the rolls and result in their uneven loading. As a consequence, the unsteady processes of rolling (biting of the strip by the rolls, discharge of the strip from the stand, changes in the stand-to-stand tension of the strip, etc.) produce vertical and horizontal vibrations of the rolls, said vibrations being of different frequencies and out of phase with each other. All this causes unstable biting of the strip by the rolls which increases the probability of its jamming in the rolls and breakdown of the rolling mill. Besides, such a process brings about thickness variations of the strip which impairs its quality.

Known in the prior art is the working stand of a rolling mill (A.I.Tselikov et al. "Machines and Mechanisms of Metallurgical Plants", M., 1981, Vol.3, Metallurgiya, p.197, Fig. IV-37), comprising housings accommodating the chocks of the upper and lower back-up rolls whose openings hold the chocks of the work rolls with their bearing assemblies, the chocks of the lower work roll having cavities on either side of the vertical axis

of the stand, said cavities accommodating the hydraulic cylinders of the counterbalancing device, the rods of said cylinders interacting with the chocks of the upper work roll.

Installation of the work roll chocks in the openings of the back-up roll chocks reduces the longitudinal movements of the work rolls with chocks and the impact loads on the bearing assemblies of said work rolls.

However, this fails to eliminate completely the clearances so that the longitudinal movements of the rolls continue to exist which results in unstable biting of the strip and, in the further process of rolling, in thickness variations of the rolled strips which impairs the quality of the rolled stock.

Besides, the impact loads on the bearing assemblies are also retained, thus curtailing the service life of said assemblies.

Also known in the prior art is the working stand of a rolling mill (A.I.Tselikov et al. "Machines and Mechanisms of Metallurgical Plants". M., 1981, Vol.3, Metallurgiya, p.259, Fig. IV-84), comprising housings accommodating the chocks of the upper and lower back-up rolls whose openings hold the chocks of the work rolls with their bearing assemblies. The chocks of the lower work roll have cavities on either side of the vertical axis, said cavities accommodating the cylinders of the counterbalancing device whose rods interact with the chocks of the upper work roll.

Installed in the chock lugs of the lower back-up roll are hydraulic cylinders for thrusting outward the back-up roll chocks in the housing. The hydraulic cylinders mounted between the back-up roll chocks serve for bending the work rolls.

There are side clearances between the work roll chocks and the lugs of the back-up roll chocks and between the latter and the housings. These clearances cause mutual longitudinal movements of the upper and lower work

and back-up rolls which, in turn, brings about unstable biting of the rolled strip and, in the course of further rolling, longitudinal thickness variations of the rolled strips. These thickness variations reduce considerably the quality of the rolled stock.

Besides, the longitudinal movements of the work rolls in the zone of said clearances impose impact loads on the bearing assemblies, thus reducing their service life.

Disclosure of the Invention

The main object of the invention is to provide the working stand of a rolling mill with the counterbalancing device designed so as to increase the quality of the rolled stock and extend the service life of the work roll bearing assemblies.

This problem is solved by providing the working stand of the rolling mill comprising housings with the chocks of the upper and lower work rolls with their bearing assemblies, the chocks of the lower work roll having cavities on either side of the vertical stand axis, said cavities accommodating the hydraulic cylinders of the counterbalancing device whose rods interact with the chocks of the upper work roll wherein, according to the invention, the total cross-sectional area of the rods of the hydraulic cylinders located on one side of the stand vertical axis is 1.05 - 3 times larger than the total cross-sectional area of the rods of the hydraulic cylinders located on the other side of the vertical stand axis.

This relation of total cross-sectional areas of the rods of the hydraulic cylinders located on both sides of the vertical stand axis permits creating minimum dynamic loads on the bearing assemblies of the rolls.

This is also characterized by minimum longitudinal movements of the work rolls in the zone of clearances between their chocks and housings.

As a result, the service life of bearing assemblies

grows 2 - 3 times, the strip biting process is stabilized and the amplitude of roll vibrations is reduced during transitional processes.

This decreases the longitudinal thickness variations of the strip and improves the quality of rolled stock.

It is practicable that the rods of the hydraulic cylinders located at one side of the vertical stand axis should have a larger diameter than the rods of the hydraulic cylinders located at the other side of the vertical stand axis.

This creates different counterbalancing forces on the upper work roll with chocks produced by the hydraulic cylinders installed on different sides of the stand vertical axis. This, in turn, results in turning of the chocks on the journals of the work rolls in the housing openings, eliminates the side clearances between the roll chocks and housings, reduces impact loads on the bearing assemblies of the rolls, extends the life of the rolls and improves the quality of rolled stock.

It is desirable that the hydraulic cylinders of the counterbalancing device located on either side of the vertical axis of the stand should have the rods of the same diameter, the number of hydraulic cylinders installed at one side of the vertical stand axis being larger than at the other side. This provides for unification of the hydraulic cylinders and takes up the side clearances between the work roll chocks and the housings. This, in turn, reduces the impact loads imposed on the bearing assemblies, extends their life and improves the quality of rolled stock.

Brief Description of the Drawings

Now the invention will be explained in greater detail by way of examples with reference to the accompanying drawings, in which:

Fig. 1 is a portion of the roughing working stand, according to the invention, at the point of installation

of work roll chocks in the housing;

Fig. 2 is a portion of the finishing working stand, according to the invention, at the point of installation of work roll chocks in the housing;

Fig. 3 is a section taken along line III-III in Fig. 2.

Best Mode of Carrying Out the Invention

The working stand of a rolling mill comprises housings 1 (Figs 1, 2) accommodating chocks 2 with the upper work roll 3 and chocks 4 with the lower work roll 5.

The chocks 4 of the lower work roll 5 on both sides of the vertical axis 6 of the stand have cavities (not shown in the drawing) accommodating hydraulic cylinders 7 and 8 of the counterbalancing device whose rods 9 and 10 interact with the chocks 2 of the upper work roll 3.

The total cross-sectional area of the rods of the hydraulic cylinders located on one side of the stand vertical axis 6, e.g. rods 10 (Fig. 2) of the hydraulic cylinders 8 is 1.05 - 3 times larger than the total cross-sectional area of the rods 9 of the hydraulic cylinders 7 located on the other side of the vertical axis 6 of the stand.

In one embodiment of the invention, the rods 10 (Fig. 1) of the hydraulic cylinders 8 located at one side of the vertical axis 6 of the stand have a larger diameter d_1 than the rods 9 of diameter d_2 of the hydraulic cylinders 7 located at the other side of the vertical axis 6 of the stand.

Such a form of the rods 9, 10 creates different counterbalancing forces applied to the chocks 2 of the upper work roll 3 at the side of the rods 9 and 10 of the hydraulic cylinders 7 and 8 located on different sides of the vertical axis 6 of the stand with the equal number of hydraulic cylinders 7 and 8 on each side of the vertical axis 6 of the stand.

As a result, the chocks 2 and 4 are shifted on the

bearing assemblies 11 of the work rolls 3 and 5 in the zone of side clearances δ between the chocks 2 and 4 and the housings 1 which eliminates the clearances δ between the chocks 2 and 4 and the housings 1.

Shown by dotted lines in Figs 1 and 2 is the position of the chocks 2, 4 of the work rolls 3 before subjecting them to the force of the hydraulic cylinders 7 and 8 of the counterbalancing device.

In another embodiment of the present invention, the rods 9 (Figs 2, 3) and 10 of the hydraulic cylinders 7 and 8 have the same diameter, the number of hydraulic cylinder, e.g. 8 (Fig. 3) on one side of the vertical axis 6 (Fig. 2) of the stand being larger than the number of hydraulic cylinders 7 located on the other side of the stand axis 6 (Fig. 2). The total cross-sectional area of the rods 10 (Fig. 3) of the hydraulic cylinders 8 is 1.33 times larger than the total cross-sectional area of the rods 9 of the hydraulic cylinders 7.

The realization of the counterbalancing device with different numbers of hydraulic cylinders 7 (Fig. 2) and 8 located at different sides of the vertical stand axis 6 provides for eliminating the side clearances δ between the chocks 2 and 4 and the housings 1 if it is impossible to install the same number of hydraulic cylinders 7 and 8 on both sides of the vertical stand axis 6 in view of peculiarities of the working stand design. This conduces to a longer life of the bearing assemblies 11 of the work rolls and to a higher precision of rolling on various types of working stands.

The working stand of a rolling mill functions as follows.

The hydraulic fluid delivered into the hydraulic cylinders 7, 8 builds up the required counterbalancing force of the upper work roll 3 and presses it against the upper back-up roll (not shown in the drawing), the force from the side of the rods 10 of the hydraulic cylinders 8 located at one side of the stand vertical axis 6 being

greater than the forces exerted by the rods 9 of the hydraulic cylinders 7 located on the other side of the stand vertical axis 6. This becomes possible because pressure in the hydraulic system is identical in both cylinders 7 and 8 while the total cross-sectional area of the rods 10 of the hydraulic cylinders 8 located at one side of the stand vertical axis 6 is 1.05 - 3 times larger than that of the rods 9 of the hydraulic cylinders 7 located at the other side of the vertical axis 6 of the stand.

Such a relationship between the total areas of the rods 9 and 10 corresponds to the minimum dynamic loads conveyed to the bearing assemblies 11 of the work rolls 3 and 5 when said rolls 3, 5 bite the strip.

As a result of the difference of counterbalancing forces on the rods 9 and 10, the chocks 2 and 4 of the work rolls are shifted in the zone of the side clearances δ. As a result of this shifting, the clearances δ are eliminated and the upper and lower ribs 12 of the chocks 2 and 4 come in contact with the back braces of the housings 1.

During transitional rolling processes such as biting of the strip by the rolls, discharge of the strip from the stand, mismatching of the roll velocities in the adjacent stands, etc. accompanied by longitudinal displacements of the work rolls 2 and 4 in the rolling direction, the chocks 2 and 4 turn periodically on the bearing assemblies 11 of the work rolls 3 and 5, with the rods 9 and 10 of the hydraulic cylinders 7 and 8 being moved in and out, so that their spaces are filled and emptied of the hydraulic fluid. The chocks 2 and 4 move in the zone of clearances δ smoothly, without impacts, because the vertical components of the horizontal loads are conveyed to the hydraulic system and damped by it.

This contributes to a reduction of dynamic loads applied to the bearing assemblies 11 of the rolls 3, 5, to limiting of the longitudinal movements of the rolls 3, 5 and, consequently, to reduced thickness variations of the rolled strips and to a higher rolling accuracy.

It has proved by investigations that a reduction in the difference between the total cross-sectional area of the rods 9 and 10 below 1.05 times causes a sharp drop in the effect of load damping and a sharp rise of the impact loads imposed on the bearing assemblies 11 of the work rolls 3 and 5 which cuts down their service life. As this difference grows in excess of 3 times, the resistance to longitudinal movements of the work rolls 3 and 5 grows sharply so that the chocks 2, 4 become practically fixed rigidly in the housings 1. In this case, in spite of elimination of side clearances δ the impact loads caused by the increased rigidity of the "work roll - housing" connection start growing noticeably which cuts down the service life of the bearing assemblies 11 of the work rolls 3, 5.

Therefore, the relationship of 1.05 - 3 between the total areas of the rods 9 and 10 located on both sides of the vertical axis 6 of the stand is an optimum one.

The advantage of the disclosed working stand consists also in that the effect of reduction of impact loads and increase in the service life of the bearing assemblies 11 of the work rolls 3, 5 and in the rolling accuracy is achieved regardless of the size of side clearances δ since they are always taken up automatically.

Thus, the use of the disclosed invention extends the life of the bearing assemblies 11 of the work rolls 3, 5 and promotes the quality of rolled stock.

Industrial Applicability

The present invention will prove most useful in wide-strip hot-rolling mills for continuous rolling at high speeds and productivity.

The utilization of the present invention raises the durability of bearing assemblies of rolls 30 - 40 %, reduces the mill downtime 15 - 20 % and improves the mill output 5 - 10 %. Besides, the longitudinal thickness variations of rolled strips diminish along with a rise in the quality of the rolling stock.

SUBJECT OF THE INVENTION

1. A working stand of a rolling mill comprising housings (1) which accommodates chocks (2, 4) of the upper and lower work rolls (3, 5) with their bearing assemblies, the chocks (4) of the lower work roll (5) on both sides of the vertical axis (6) of the stand having cavities accommodating the hydraulic cylinders (7, 8) of the counterbalancing device whose rods (9, 10) interact with the chocks (2) of the upper work roll (3), c h a r a c t e r i z e d in that the rods (10) of the hydraulic cylinders (8) arranged at one side of the vertical axis (6) of the stand have a total cross-sectional area 1.05 - 3 times larger than the total cross-sectional area of the rods (9) of the hydraulic cylinders (7) arranged at the other side of the vertical axis (6) of the stand.

2. A working stand of a rolling mill as claimed in Claim 1, c h a r a c t e r i z e d in that the rods (10) of the hydraulic cylinders (8) of the counterbalancing device arranged at one side of the vertical axis (6) of the stand are of a larger diameter than the rods (9) of the hydraulic cylinders (7) arranged at the other side of the vertical axis (6) of the stand.

3. A working stand of a rolling mill as claimed in Claim 1, c h a r a c t e r i z e d in that the hydraulic cylinders (7, 8) of the counterbalancing device arranged at different sides from the vertical stand axis (6) have the rods (9, 10) of the same diameter, the number of hydraulic cylinders (8) installed at one side of the vertical stand axis (6) being larger than it is at the other side of said axis.

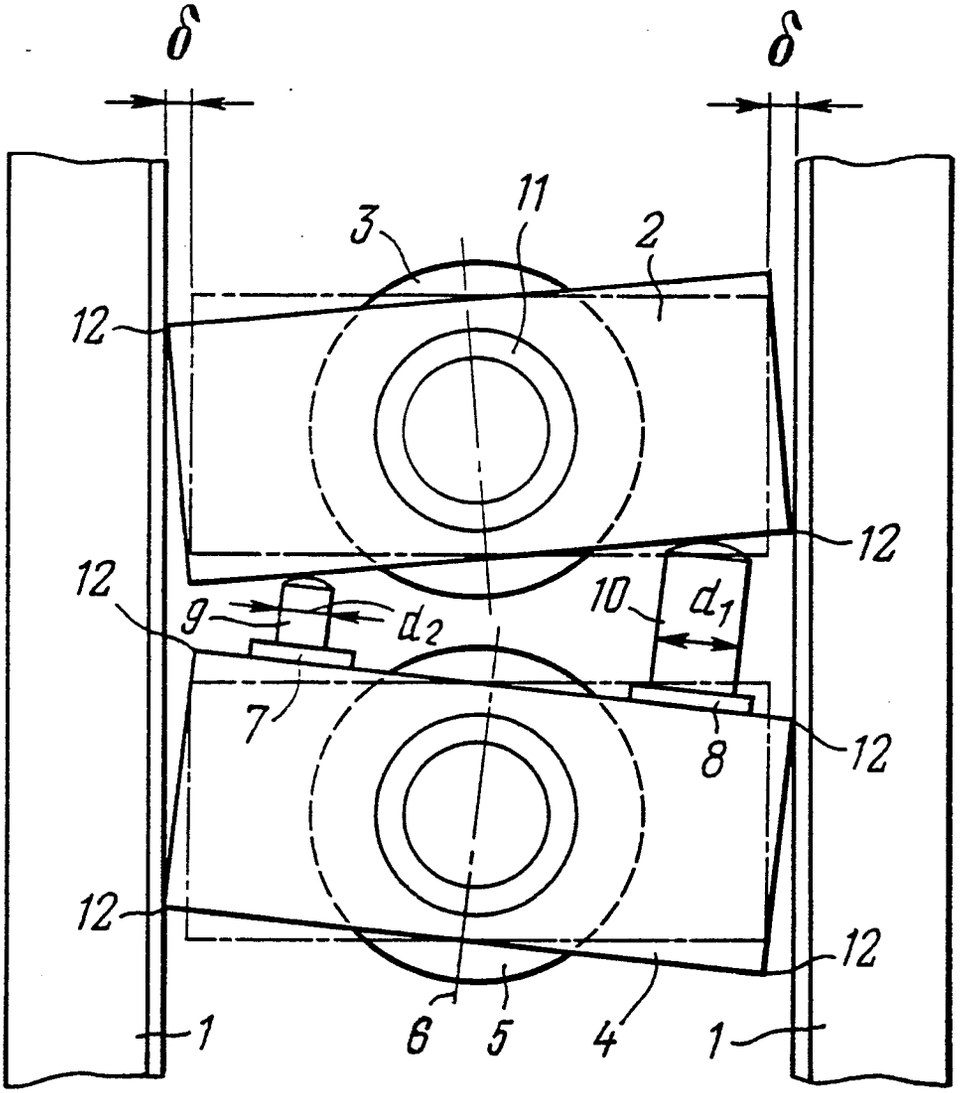

FIG.1

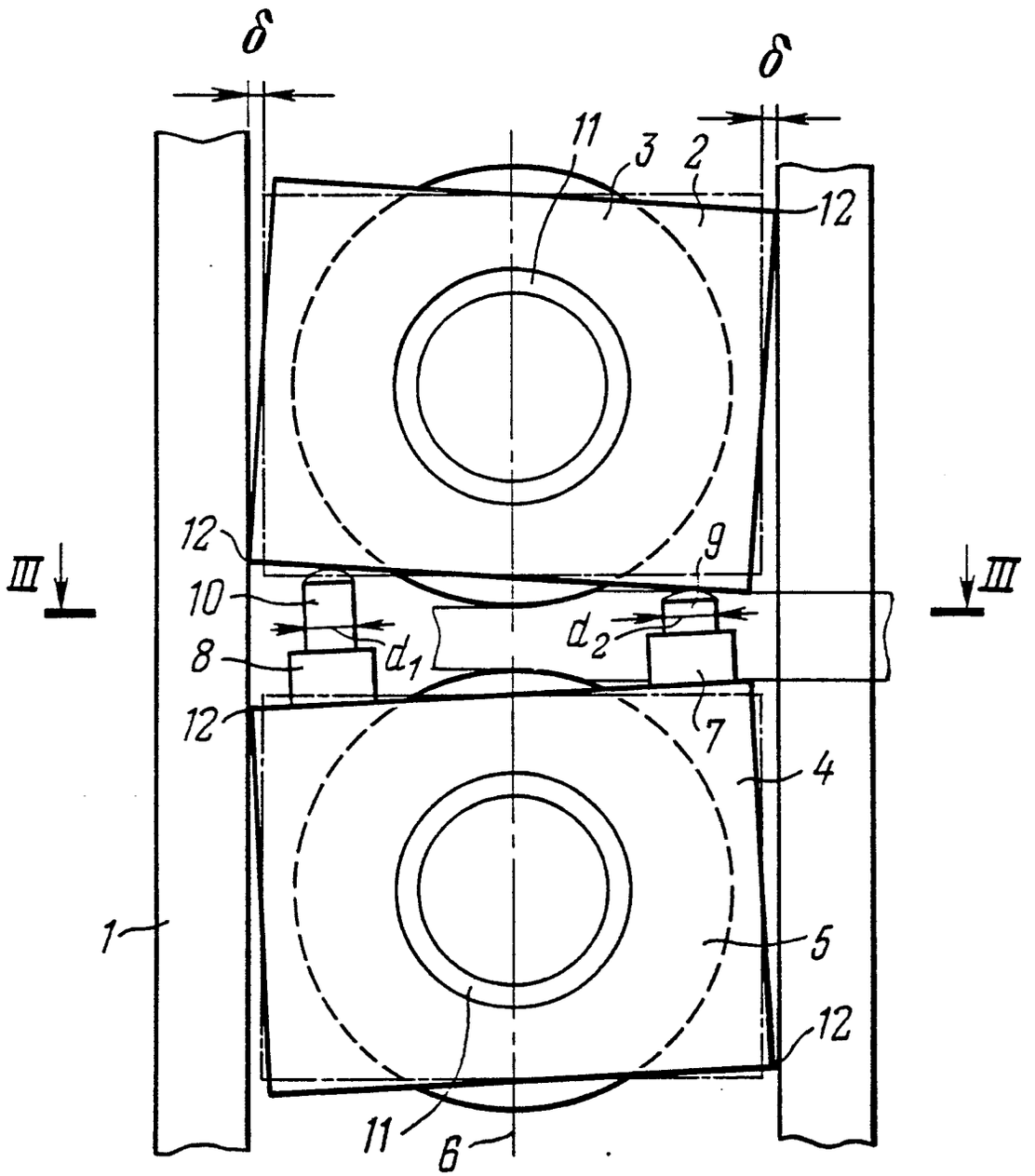

FIG.2

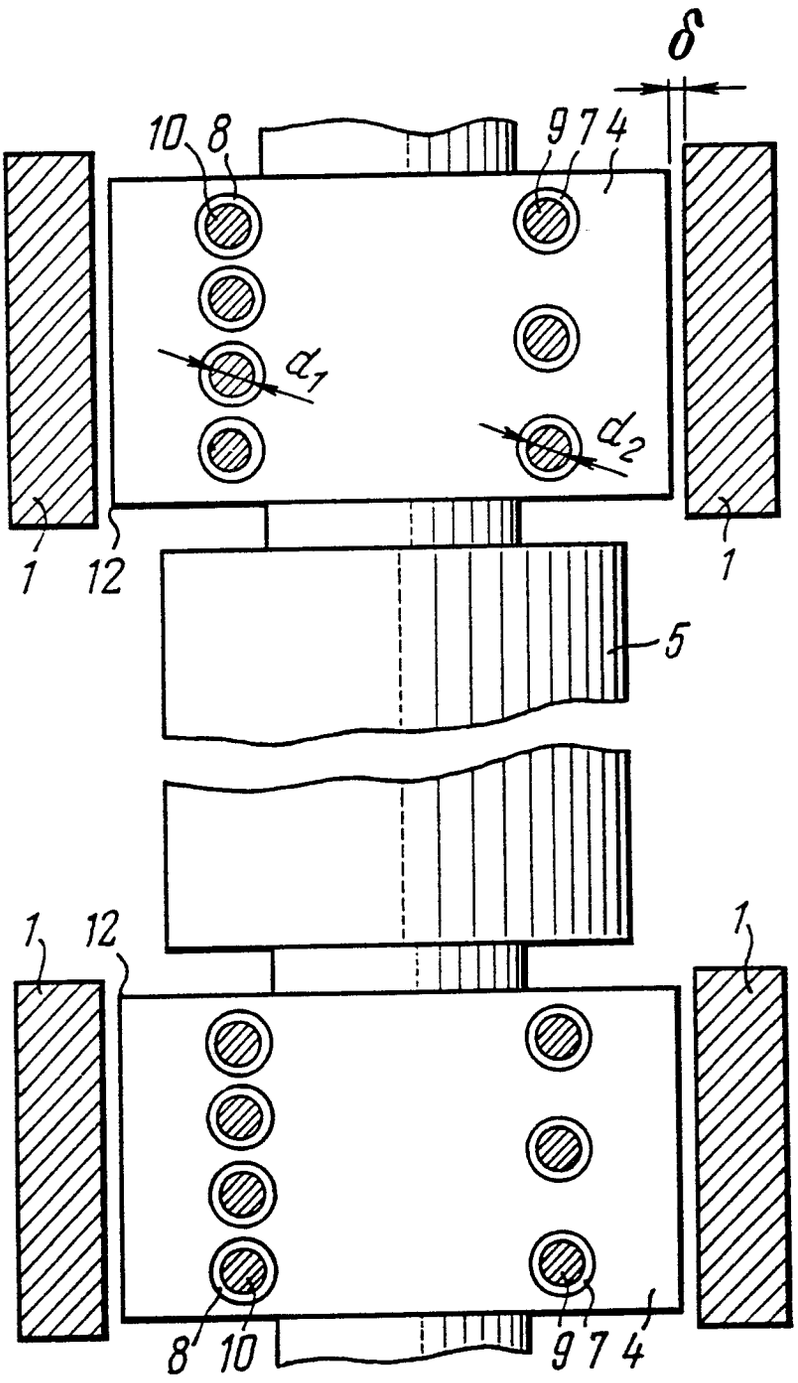

FIG.3

INTERNATIONAL SEARCH REPORT

International Application No PCT/SU 88/00229

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5] - B 21 B 13/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	B 21 B 13/00, 13/02, 31/04

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No [13]
A	SU,A1,1276384 (Proizvodstvennoe obiedinenie "Uralmash") 15 December 1986 (15.12.86),see the claims,column 1,lines 32-39,the drawing	1-3
A	SU,A1,959858(VSESOJUZNY ZAOCHNY POLITEKHNICHESKY INSTITUT ET AL.) 25 September 1982(25.09.82)see the claims,column 4,lines 8-17, the drawing	1-3
A	SU,A1,789170 (KOLPINSKOE OTDELENIE VSESOJUZNOGO NAUCHNO-ISSLEDOVATELSKOGO I PROEKTNO-KONSTRUKTORSKOGO INSTITUTA METALLURGICHESKOGO MASHINOSTROENIA NAUCHNO-PROIZVODSTVENNOGO OBIEDINENIA "VNIIMET-MASH") 23 December 1980 (23.12.80),see the claims column 4,lines 19-33, figure 1	1-3
A	SU,A1,1355308 (ZAPOROZHSKY INDUSTRIALNY INSTITUT) 30 November 1987(30.11.87),see the claims,column 1,lines 34-50	1-3
A	DE,B1,1201798 (DEMAG AKTIENGESELLSCHAFT) 30 September 1965 (30.09.65),see column 2, lines 36-53, figure 2	1-3

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
04 July 1989 (04.07.89)	07 August 1989 (07.08.89)
International Searching Authority	**Signature of Authorized Officer**
ISA/SU	