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

(72) Inventor: **SUVOROV, Ivan Kapitonovich**

deceased(SU)

Inventor: **PLAKHTIN, Vladimir Dmitrievich**
ul. 16 Parkovaya, 55-1-95
Moscow, 105523(SU)

Inventor: **GRISHANOV, Alexei Georgievich**

ul. Stroitelei, 6-25 Moskovskaya obl.

Ljubertsy, 140006(SU)

Inventor: **DANILOV, Leonid Ivanovich**

ul. Vereschagina, 51-8, Vologodskaya obl.

Cherepovets, 162606(SU)

Inventor: **TISHKOV, Viktor Yakovlevich**

ul. Lenina, 108b-57, Vologodskaya obl.

Cherepovets, 162610(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 WC1V 7LE(GB)

(54) **MILL ROLL.**

(57) A mill roll comprises a barrel casing (1) secured on a shaft (2) by means of a thread (11) between the turns of which on the shaft (2) is provided a spiral groove (12) for removing a coolant, connected to an annular cavity (9) between the external surface of the shaft (2) and the internal surface (8) of the barrel casing (1), the shaft (2) being provided inside with an axial opening which is stepped and blind and extends within the limits of the length of the barrel casing (1). The step (13) of the axial opening (5) of the larger diameter forms, together with the external surface of a tube (6) for feeding the coolant, mounted in said axial opening (5), an annular cavity (14) for removing the coolant, connected through a radial opening (10) to the annular cavity (9) between the

external surface of the shaft (2) and the internal surface (8) of the barrel casing (1).

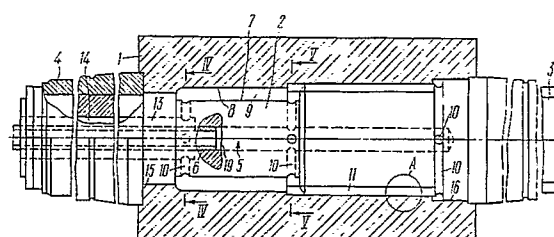


FIG.1

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MILL ROLL

Field of Art

The present invention relates to rolling-mill practice and, more specifically, to a mill roll.

Prior Art

At present, the strength and durability of the mill roll are rather low due to a poor efficiency of roll band cooling.

Owing to ineffective cooling of the band, its material is subjected to heavy thermal stresses which result in cracking of the band thus impairing its strength and leading to its ultimate failure.

Known in the prior art is a roll mill (SU, A, 435022) comprising a band secured on its axle by a taper thread self-tightening during rotation of the roll, said axle having a driven journal and a non-driven journal.

Owing to the use of the taper thread the torque is transmitted from the axle to the band. Cooling of the roll is carried out by pouring water on it which originates sharp thermal cycling of the areas of the band external surface at the moments of entry and exit from the centre of deformation. This produces cyclic thermal stresses in the band material causing thermal cracks which reduce the strength and durability of the roll.

Known in the prior art is a mill roll (SU, A, 567517) comprising a band fixed on an axle having driven and non-driven journals, said axle being provided with an axial hole which accommodates a coolant inlet pipe has a circular recess on the external surface which forms, together with the internal surface of the band, a circular space connected with the axial hole through radial channels in the axle. The system of channels, holes and slots in the axle is hermetically closed and partly filled with coolant, i.e. a liquid with a low boiling temperature, for example, freon. The roll is cooled by this liquid which evaporates when it comes in contact with the internal surface of the band and condenses when vapours come in contact with the colder external surface of the axle. Heat is abstracted from the roll by the coolant flowing through the pipe.

Internal cooling of the roll decreases the temperature difference on various areas of the band located in the centre of deformation and in the atmosphere with a resultant reduction of cyclic thermal stresses in the band material, decreased cracking and increased strength and durability of the band.

However, the band cannot be uniformly cooled

lengthwise by the coolant admitted at one end of the pipe and discharged at the other, because the coolant entering the pipe is colder and cools this side of the band more intensively. At the coolant outlet from the pipe, the band is cooled less intensively because the coolant temperature here is higher than it is at the inlet end of the pipe. There arises a temperature difference along the band, resulting in its nonuniform deformation which causes heavy thermal stresses in the band material, reduces the strength and durability of the band and the roll as a whole.

Disclosure of the Invention

The main object of the invention is to provide a mill roll with its axle and band designed so as to increase the strength and service life of the roll.

This object is attained in the mill roll comprising a band fixed on an axle having driven and non-driven journals and an axial hole accommodating a coolant inlet pipe, a circular recess on its external surface forming, together with the internal surface of the band, a circular space connected by radial channels in the axle with the axial hole wherein, according to the intention, the band is fixed on the axle by means of a thread with the coolant outlet helical groove located between the thread turns on the axle, said groove communicating with the circular space between the external surface of the axle and the internal surface of the band, the axial hole is blind and stepped within the limits of the band length, the larger diameter step being located at the side of the non-driven journal and forms, together with the external surface of the coolant inlet pipe, a circular space for the discharge of coolant, said space communicating through at least one radial channel with the circular space between the external surface of the axle and the internal surface of the band.

The provision of a helical groove between the thread turns on the axle, communicating with the circular space between the axle and the band and further, through radial channels, with the circular space between the external surface of the pipe and the large-diameter step of the axial hole ensures admission of the coolant at the same temperature to different areas of the internal surface of the band. This ensures intensive cooling and uniform distribution of temperature throughout the length of the band which excludes heavy thermal stresses in the material of the band, reduces considerably the formation of cracks, improves strength and extends the service life of the band and the roll as a whole.

It is practicable that the circular space between the external surface of the axle and the internal surface of the band should be of the sectional type, each section communicating with the axial hole through at least one radial channel.

This creates additional areas of the mounting conjugated surface of the band and axle, reduces sagging and increases stiffness of the band in the course of rolling which decreases stresses in the material of the band, increases its strength and durability.

It is desirable that the coolant inlet pipe should be installed in the axial hole so that its end protrudes somewhat beyond the limits of the large-diameter step of said axial hole while in the small-diameter step of the axial hole it should be installed immovably.

In such an arrangement of the pipe, the incoming and outcoming flows of coolant are reliably separated which rules out their mixing and preheating of the incoming flow of coolant. As a result, the coolant delivered to the internal surface of the band has a sufficiently low temperature thus providing for intensive abstraction of heat and cooling of the band, reducing the thermal stresses in its material, and increasing the strength and durability of the band.

Thus, the use of the disclosed invention enhances the strength and durability of the mill roll while transmitting the rolling torque from the axle to the band.

Brief Description of the Drawings

The invention will now be explained in greater details by way of example with reference to the accompanying drawings, in which:

Fig. 1 shows schematically the mill roll, according to the invention, sectional view with cut-away fragments;

Fig. 2 - same as in Fig. 1, another design of the axle;

Fig. 3 - fragment A in Fig. 1, enlarged;

Fig. 4 is a section taken along line IV-IV in Fig. 1;

Fig. 5 is a section taken along line V-V in Fig. 1.

Best Mode of Carrying Out the Invention

The mill roll comprises a band 1 (Figs 1, 2) fixed on an axle 2 having a driven journal 3 and a non-driven journal 4. The axle 2 has a hole 5 accommodating a coolant inlet pipe 6. The external surface of the axle 2 is provided with a circular recess 7 which forms, together with the internal surface 8 of the band 1, a circular space 9 con-

nected with the axial hole 5 through radial channels 10 in the axle 2.

The band 1 is secured on the axle 2 by means of buttress thread 11 cut on one of the areas of contact between the axle 2 and the band 1. A helical groove 12 (Fig. 3) made between the turns of said thread 11 on the axle 2 and communicating with the circular space 9 (Figs 1, 2) serves for discharging the coolant.

The axial hole 5 within the limits of the band 1 is blind and stepped. The large-diameter step 13 is located at the side of the non-driven journal 4 and forms, together with the external surface of the pipe 6, a circular space 14 (Figs 1, 2, 4) for letting out the coolant, communicating through at least one radial channel 10 with the circular space 9 located between the external surface of the axle 2 and the internal surface 8 of the band 1. The coolant is delivered to the helical groove 12 (Figs 2, 3) through the axial hole 5 and the radial channels 10 in the axle 2.

The band 1 is mated with the axle 2 by a tight fit over surfaces 15 and 16.

The provision of the helical groove 12 between the turns of the thread 11 on the axle 2, communicating with the circular space 9 between the axle 2 and band 1 and further, through the radial channels 10, with the circular space 14 between the external surface of the pipe 6 and the axle 2 at the point of the large-diameter step 13 of the axial hole 5, ensures the delivery of coolant at the same temperature to the thread 11 and the internal surface 8 of the band 1 through the radial channels 10. This creates intensive and uniform cooling of the band 1 throughout its length which rules out heavy thermal stresses in the material of the band 1, reduces cracking considerably, thereby increasing the strength and durability of the band 1 and the roll as a whole.

In another design of the axle (Fig. 2) the circular space 9 between the external surface of the axle 2 and the internal surface 8 of the band 1 is of a sectional design. Each section communicates with the axial hole 5 through at least one radial channel 10. The sections are separated by mounting surfaces 15 and 17. The sections of the circular space 9 are in communication through longitudinal channels 18 (Figs 2, 5) in the axle 2 on the mounting surface 17 at the point of its conjugation with the band 1 (Fig. 2). The sectional design of said circular space creates additional areas of the mounting surface of conjugation between the band 1 and the axle 2 which reduces sagging and promotes stiffness of the band 1 in the course of rolling. This, in turn, reduces stresses in the material of the band 1 and improves its strength and durability.

The coolant inlet pipe 6 is accommodated in

the axial hole 5 in such a manner that its end protrudes a little, as compared with the length of the small-diameter step 19, beyond the limits of the large-diameter step 13 of the axial hole 5.

The coolant inlet pipe 6 is immovably installed in the small-diameter step 19 (Figs 1, 2) of the axial hole 5.

Such installation of the pipe 6 provides for hermetic separation of the coolant flows entering and leaving the roll so that it prevents their mixing and preheating of the entering flow of coolant. As a result, the coolant coming to the internal surface 8 of the band 1 has a sufficiently low temperature thus ensuring intensive abstraction of heat and cooling of the band 1, reducing thermal stresses in its material, promoting the strength and durability of the band.

The mill roll functions as follows.

In the course of rolling the coolant (water or emulsion) flows through the pipe 6, through the small-diameter step 19 of the axial hole 5 and radial channels 10 into the helical groove 12 of the thread 11 and to the internal surface 8 of the band 1. The entire surface of the band 1 is simultaneously cooled, ensuring uniform distribution of temperature and intensive abstraction of heat throughout the length of the band 1. This reduces the thermal stresses in the material of the band 1, improves its strength and durability.

Having cooled the band 1, the coolant flows through the helical groove 12 and radial channels 10 in the axle 2 which intercommunicate the circular spaces 9 and 14, and is discharged from the roll into the cooling system for reuse (the system is not shown in the drawings).

Thus, the use of the disclosed invention increases the strength and durability of the roll by improving the efficiency of its cooling while transmitting the rolling torque from the axle to the band.

Industrial Applicability

The present invention will be used most successfully in wide-strip hot-rolling mills. Introduction of the present invention raises the strength and durability of the roll at least twice.

Claims

1. A mill roll comprising a band (1) secured on the axle (2) which has driven and non-driven journals (3, 4) and an internal axial hole (5) accommodating a coolant inlet pipe (6) while its external surface has a circular recess (7) forming, together with the internal surface of the band (1), a circular space (9) communicat-

ing through radial channels (10) in the axle (2) with the axial hole (5), **characterized** in that the band (1) is fixed on the axle (2) by a thread (11) having a coolant outlet groove (12) between its turns on the axle (2), said groove communicating with the circular space (9) between the external surface of the axle (2) and the internal surface of the band (1), the axial hole (5) within the limits of length of the band (1) being made blind and stepped with the large-diameter step (13) located at the side of the non-driven journal (4) and forming, together with the external surface of the pipe (6), a circular coolant outlet space (14) communicating through at least one radial channel (10) with the circular space (9) between the external surface of the axle (2) and the internal surface (8) of the band (1).

2. A mill roll as claimed in Claim 1, **characterized** in that the circular space (9) between the external surface of the axle (2) and the internal surface (8) of the band (1) is of the sectional type, each section communicating with the axial hole (5) through at least one radial channel (10).
3. A mill roll as claimed in Claim 1, **characterized** in that the coolant inlet pipe (6) is so located in the axial hole (5) that its end protrudes beyond the limits of the large-diameter step (13) of the axial hole (5) and is installed immovably in the small-diameter step (19) of the axial hole (5)

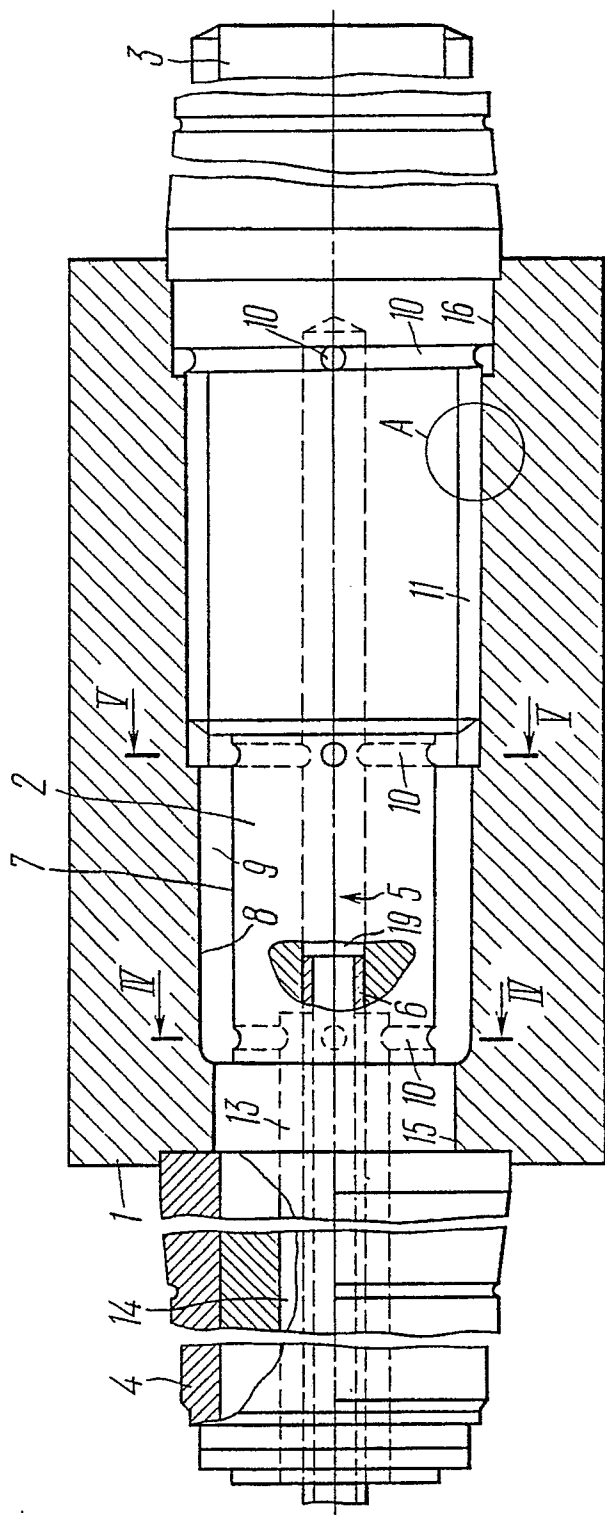


FIG. 1

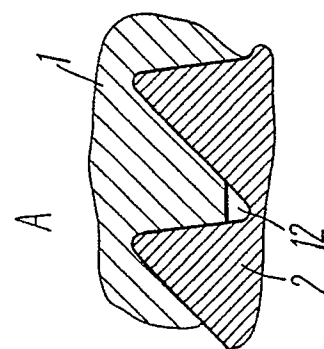


FIG. 3

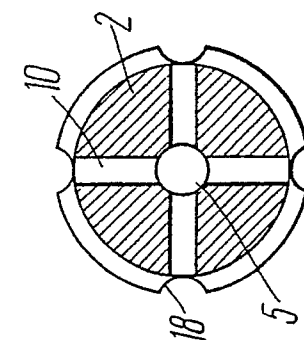


FIG. 4

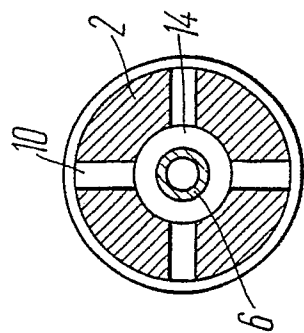


FIG. 5

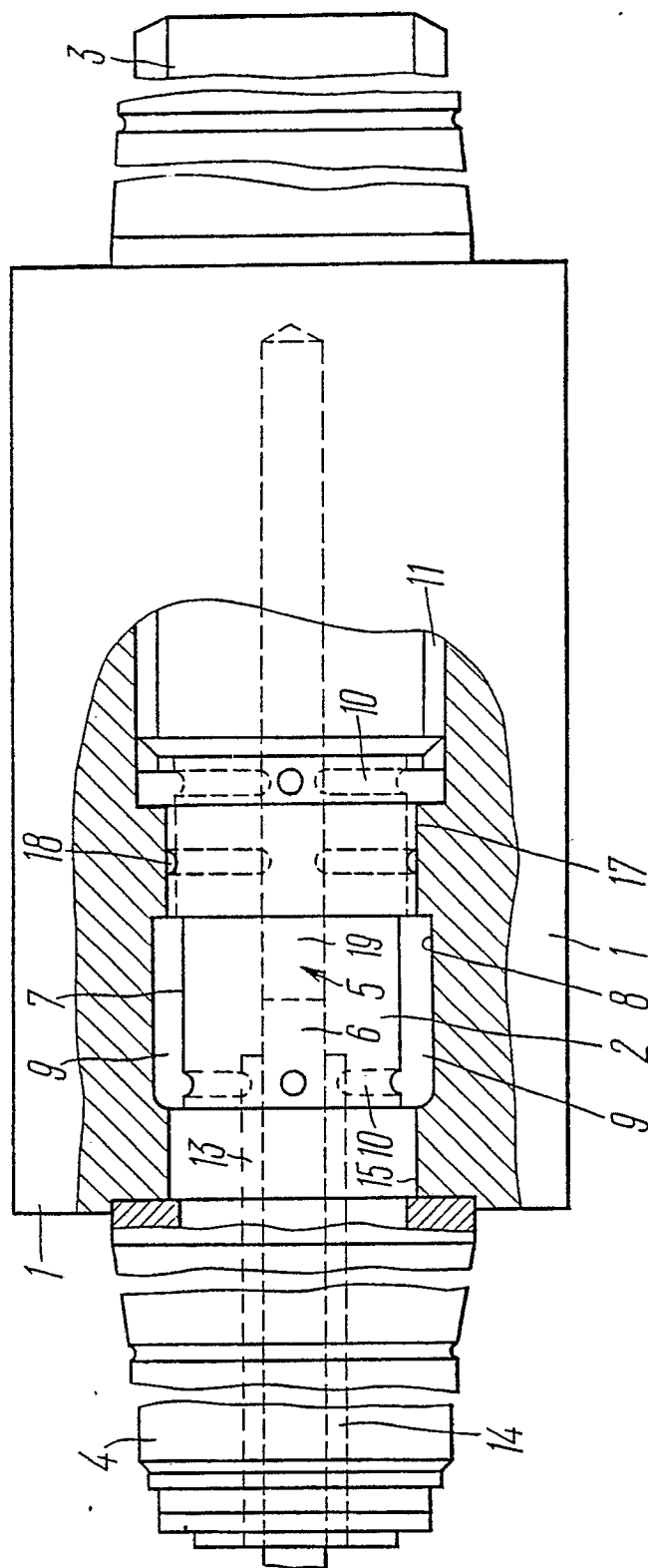


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/SU 88/00246

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 B21B 27/02, 27/08		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁵	B21B 27/02, 27/08	
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 ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	SU, A1, 567517 (Magnitogorsky gorno-metallurgichesky institut) 8 September 1977 (08.09.77) see column 3, lines 16-36 (cited in the description)	1
A	SU, A1, 735345 (Moskovsky institut stali) 27 May 1980 (27.05.80) see the claims, figures 1,2	1
A	SU, A1, 689753 (Magnitogorsky gorno-metallurgichesky institut et al.) 8 October 1979 (08.10.79) see column 2, lines 17-24, figures 1,2	1
⁹ 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	
18 July 1989 (18.07.89)	7 August 1989 (07.08.89)	
International Searching Authority	Signature of Authorized Officer	
ISA/SU		