United States Patent

Sevenich et al.

[15] **3,695,080**

[45] **Oct. 3, 1972**

[54] **SYSTEM FOR THE REPLACEMENT OF ROLLING-MILL ROLLS**

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[22] Filed: **Oct. 14, 1970**

[21] Appl. No.: **80,666**

[30] **Foreign Application Priority Data**

Oct. 18, 1969 Germany.....P 19 52 646.6

[52] **U.S. Cl.**.....**72/239**

[51] **Int. Cl.**....**B21b 31/08,** B21b 31/10, B21b 31/32

[58] **Field of Search**.....72/236, 237, 238, 239, 241, 72/243, 244, 245

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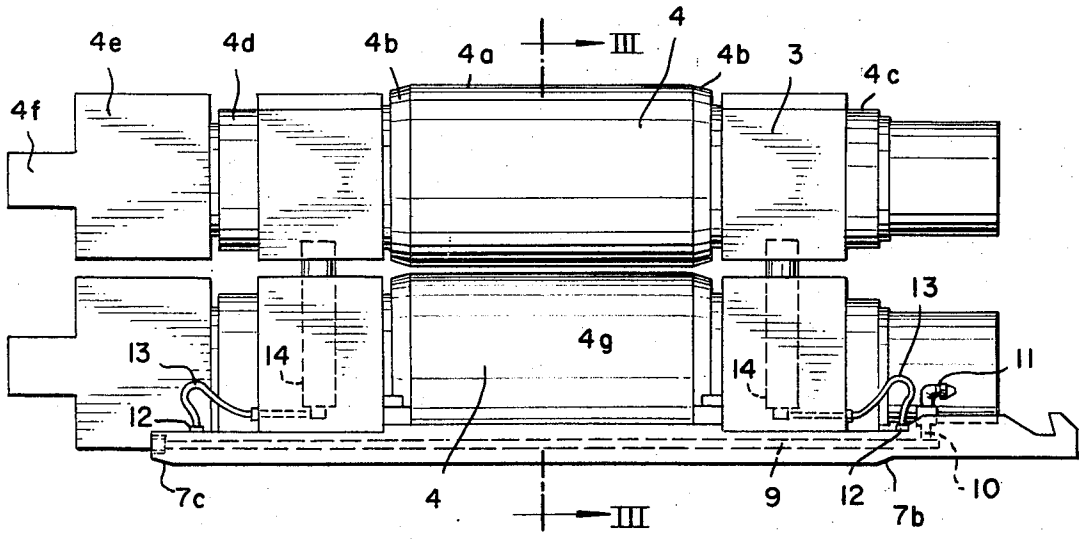
[57] **ABSTRACT**

A pair of rolling-mill rolls, to be replaceably inserted in a rolling-mill stand, is mounted upon a skid carried parallel to the rolling direction and shiftable bodily in the horizontal transverse direction to carry the rolls into the stand. The members of the skid are provided with hydraulic ducts connected to positioning cylinders on the lower roll for spacing the rolls apart.

6 Claims, 4 Drawing Figures



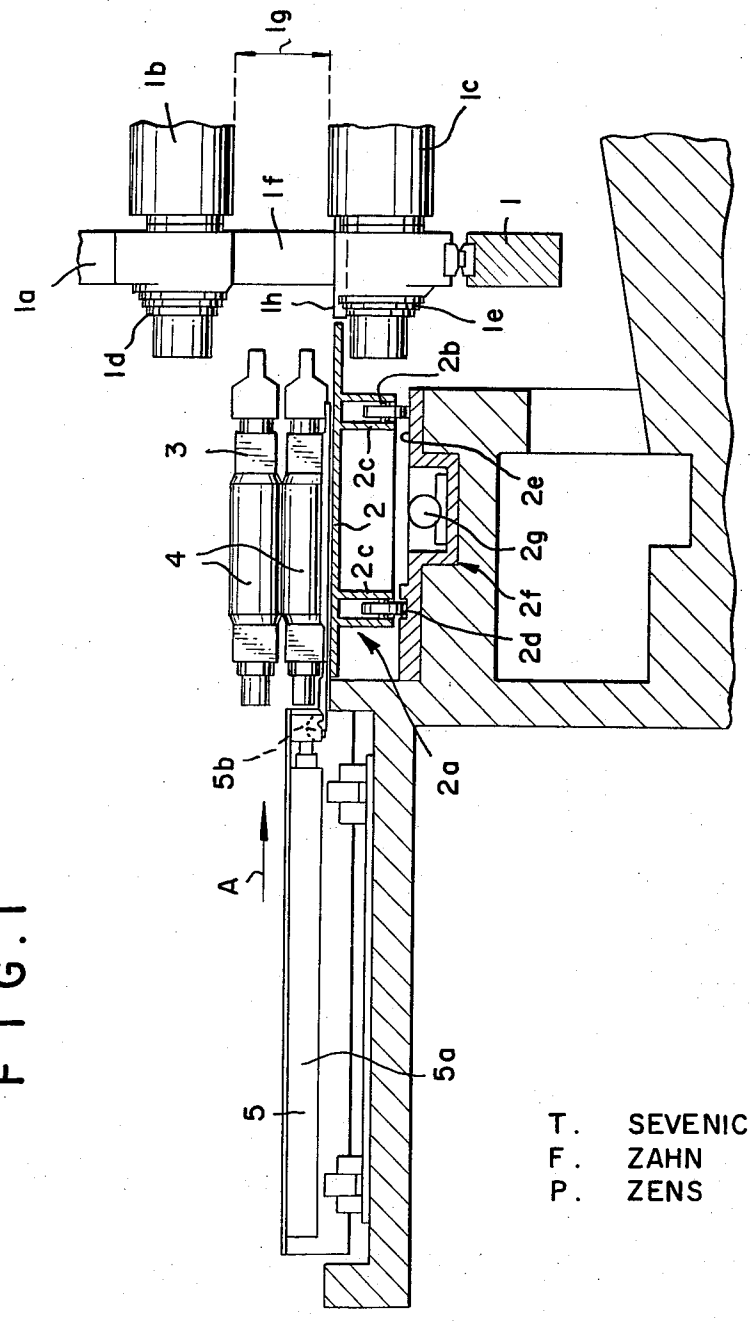


FIG. 1

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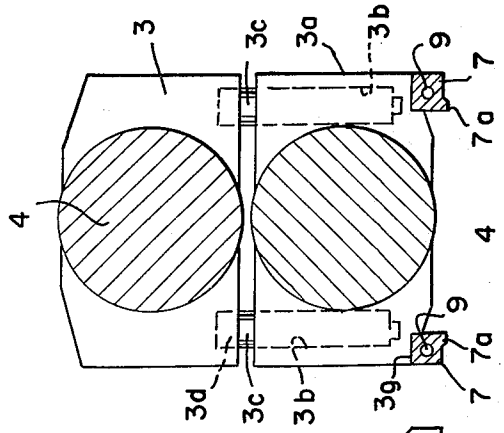

FIG. 3

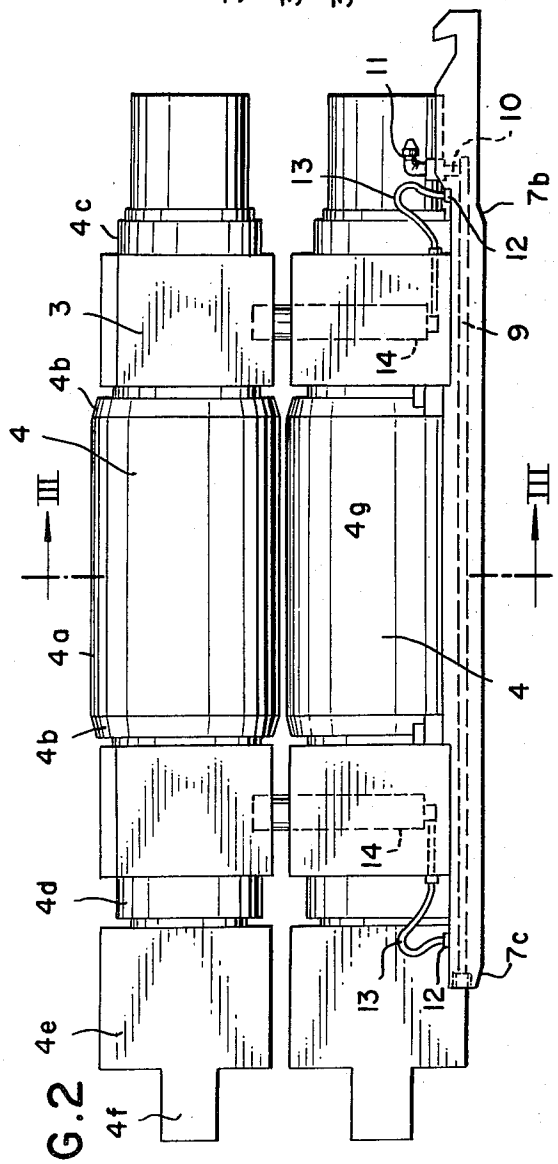

FIG. 2

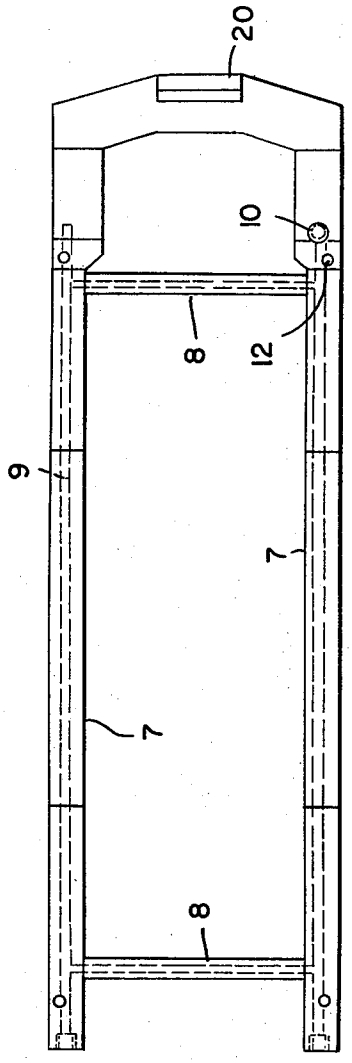

FIG. 4

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SYSTEM FOR THE REPLACEMENT OF ROLLING-MILL ROLLS

FIELD OF THE INVENTION

The present invention relates to a system for the removal and insertion of rolling-mill rolls in a rolling-mill stand and, more particularly, to improvements in replaceable, exchangeable and interchangeable rolling-mill rolls, especially for continuous-band rolling.

BACKGROUND OF THE INVENTION

A rolling mill for billets, a blooms, bars and other elongated workpieces generally comprises a plurality of installations spaced along the rolling path, each including a rolling-mill stand and a pair of horizontal working rolls journaled therein for squeezing the elongated workpiece between them. Such mills are employed, for example, in the continuous rolling of strip, band and sheet stock from metal billets, blooms, ingots, bars and the like.

Frequently, the rolling-mill stand also carries a pair of back-up rolls respectively engaging and tangent to the upper and lower working rolls and having axes of rotation coplanar therewith for supporting the working rolls against the bending pressures generated when a workpiece of larger thickness than the rolling gap is forced between the working rolls. The working rolls may each be provided with a journal at its opposite ends which are held in the rolling-mill stand, support or frame and serves to enable the rolling-gap width to be adjusted to the thickness necessary for strip, band and sheet stock. The adjusting means may include a hydraulic jack or like piston-and-cylinder arrangement disposed between the journal blocks of the working rolls.

Since the working rolls are subject to severe mechanical and thermal stresses, and the surface equal of the working rolls determines the characteristics of the finished material, it is necessary to provide for exchange, replacement or interchange of the working rolls.

Consequently prior art systems have provided means whereby the working rolls of a rolling-mill stand can be removed and introduced without necessitating a complete disassembly of the entire installation.

Such systems have generally provided a means for positioning one or more working rolls along a side of the rolling-mill stand, means for lifting the rolls therein and laterally shifting the rolls out of the stand, and means for feeding a fresh roll into the stand also in the lateral direction. For a proper orientation with respect to these directions, it is important to note that the rolling path is tangential to the working rolls and is horizontal while the rolls have horizontal axes parallel to one another (and to any back-up rolls) and parallel to the surface of the rolled body but running transversely to the rolling direction. Hence, when reference is made herein to lateral insertion or removal of the working rolls, it is intended to so describe a movement of the working rolls parallel to or in the direction of their axes, but transversely to the rolling direction. Each rolling-mill stand may be provided with an opening through which the lateral movement of the rolls is enabled.

For the most part, the prior art systems for replacing the working rolls of a rolling mill have required large amounts of manual labor, long downtimes for the installation, etc.

OBJECT OF THE INVENTION

It is the principal object of the present invention to provide an improved rolling-mill installation and system for replacing the working rolls thereof whereby the aforementioned disadvantages are obviated.

It is another object of the invention to provide an improved system for removing working rolls from and introducing working rolls to a rolling-mill installation which requires a minimum of manual labor and also minimizes the downtime of the installation.

A further object of the is the provision of an improved system for replacing the working rolls of a rolling mill for the production of continuous bands or strips of metal.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with the present invention, in a system for replacing the working rolls of a rolling mill and which comprises a skid carrying the working rolls and shiftable in a direction parallel to the rolling direction ahead of an opening provided in the rolling-mill stand and into which the working rolls are subsequently inserted. The skid has an opening through which the lower roll rests upon its backing roll.

More specifically, the apparatus for replacing the working rolls of a rolling mill and especially the working rolls of continuously operating strip or band rolling mills comprises a plate or platform displaceable by a suitable drive along the rolling path and parallel to the rolling direction ahead of the rolling stand which has a lateral opening in which pairs of working rolls can be accomodated. It has been found, surprisingly, that the disadvantages of the earlier systems enumerated above can be eliminated entirely if, upon this plate, the working rolls are carried by a slide which is shiftable bodily into the rolling-mill stand and can be inserted therein and withdrawn therefrom with a pair of working rolls in superposed relation. The slide or skid may, according to this invention, cradle the lowermost working roll and may be provided with means engageable with the insertion and retraction apparatus, i.e. a piston-and-cylinder arrangement reciprocal to withdraw the previous pair of working rolls out of the stand through the aforementioned opening or to insert a new pair of rolls through the opening once the first-mentioned pair has been removed. The skid, according to the instant invention, has a pair of longitudinally extending bars or runners along which the journal blocks of the lower working rolls rest, these journal blocks, in turn, carrying the journal blocks of the upper roll via hydraulic-jack means.

According to the instant invention, the skid is further provided with duct means connectable to a hydraulic or pneumatic network and communicating, in turn, with the fluid-responsive gap adjuster for the working rolls. The gap adjuster may be hydraulic or pneumatic cylinders provided between the journal blocks of the lower rolls and the journal blocks of the upper rolls.

Still another feature of the present invention resides in the provision of a snap-action, quick-release, high-

pressure coupling including a first coupling member upon the skid and a mating coupling member upon the rolling-mill stand and interengageable automatically upon the insertion of the skid and the working rolls carried hereby into the stand through the opening. The coupling may be of the male-female or plug-socket type and the mating members are axially aligned along an axis which is offset from but parallel to the axis of the rolls. Preferably, the skid is formed with a cross piece (between runners) which is engageable by the fluid-responsive feed assembly and is located at the ends of the working rolls remote from their drive extremities. The drive extremities of the working rolls may, of course, be receivable in drive sockets of any conventional configuration. It has also been found to be desirable to provide the gap-adjusting means with a facility to relieve the pressure upon the working rolls when the latter is to be withdrawn from the manner previously described. For the most part, best results are obtained when the hydraulic connection is automatic as the slide or skid is inserted, the connection being made at the driving side of the stand.

The system of the present invention and described briefly above, has numerous advantages aside from the fact that it enables the working rolls with the associated journal blocks and spacer arrangement to be removed rapidly from the rolling stand, to be inserted therein or to be replaced. Of greater significance is the reduction in the amount of manual labor which has hitherto been required for positioning, displacing and reconnecting the working rolls of a rolling mill for bands and the like.

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a vertical cross section taken generally transversely to the rolling direction of a rolling mill diagrammatically illustrating the invention.

FIG. 2 is an elevational view, drawn to an enlarged scale, of the replaceable rolling-roll assembly;

FIG. 3 is a cross-sectional view taken along the line III — III of FIG. 2; and

FIG. 4 is an elevational view of a skid for use with the system of FIGS. 2 and 3.

SPECIFIC DESCRIPTION

In FIG. 1 of the drawing there is shown a rolling mill, in part represented at 1, which comprises the usual stand 1*a* within which back-up rolls 1*b* and 1*c* are journaled in respective blocks 1*d* and 1*e*. The stand 1*a* is provided with an opening 1*f* adapted to permit insertion and removal of the working rolls 4 which fit into the gap 1*g* between the take-up rolls 1*b* and 1*c*. A platform 1*h* upon the stand 1*a* serves as a guide for the skid 7 – 12 carrying the working rolls into the installation. The means for driving the rolls are, of course, conventional and need not be described here.

The working rolls 4, as best seen in FIGS. 1 – 3, each comprise a rolling central portion 4*a* having chamfered ends 4*b* and cylindrical bearing portions 4*c* and 4*d* at opposite axial extremities of the roll. At one end, each of the rolls 4 may be formed with a fitting 4*e* having a noncircular tongue 4*f* receivable in a complementary socket of the drive means.

Each of the rolls 4 is, moreover, journaled in a block 3 serving to rotatably support the rolls relative to one another and to accommodate spacing means as well as the means for adjusting the rolling gap 4*g*. The rolls and installation illustrated in FIGS. 1 and 2 are those of a band or strip mill as already indicated.

As best seen in FIGS. 2 and 3, each of the lower journal blocks 3*a* is provided with a pair of cylinders 3*b* accommodating hydraulic plungers 3*c* which project into and are received within recesses 3*d* formed in the upper bearing block. When hydraulic fluid is introduced into the cylinders 3*b* below the plungers 3*c*, therefore, the pairs of bearing blocks 3, 3*a* are urged apart.

As the rolls are inserted into the mill, the cylinders are pressurized to hold the rolls 4 apart. Since the workpiece forced through the gap 4*g* is thicker than the gap width, the compression of the workpiece will generate vertical forces which are transferred by the working rolls 4 to the respective back-up rolls 1*b* and 1*c*.

According to the principles of the present invention, alongside the rolling mill 1 and parallel to the direction of rolling (perpendicular to the plane of the paper in FIG. 1), there is provided a drive arrangement having one or more plates or platforms 2. The platforms 2 preferably constitute the upper surfaces of carriages 2*a* which may have a chassis 2*b* rotatably supporting wheels 2*c* received in a channel-shaped track 2*d* and upon a flat rolling surface 2*e* of a guideway 2*f* shown diagrammatically in FIG. 1. The means for shifting the carriages along this guideway is represented diagrammatically at 2*g* and may be an electric or fluid motor.

As is also apparent from FIG. 1, the upper surface 2*h* of the platform 2 is coplanar with the surface 1*h* of the receiving table so that the working-roll assembly can be shifted into the installation 1 with ease.

In the vertical plane of the axes of the back-up rolls 1*b* and 1*c* and, of course, of the working rolls 4 when they are in position, there is provided a pusher assembly generally represented at 5 for inserting and withdrawing the working rolls. To this end, the assembly 5 may comprise a piston-and-cylinder arrangement 5*a* of the telescoping type, the head 5*b* of which is provided with a downwardly open recess adapted to engage a hook-shaped formation 20 upon the skid as will be described in greater detail hereinafter. When the hydraulic cylinder arrangement 5*a* extends, therefore, it thrusts the working-roll assembly to the right (arrow A) through the opening 1*f* in the stand 1*a* of the mill, and thereby positions the working rolls 4 in the latter. The head 5*b* is tilted upwardly to release the hook 20 and the cylinder is withdrawn. When it is desired to replace an existing set of working rolls, however, an empty platform 2 is positioned ahead of the opening 1*f*, the cylinder 5*a* is extended to permit the head 5*b* to engage the hook 20 of the skid of the assembly, the cylinder 5*a* is retracted to withdraw the skid and the working rolls 4 carried thereby onto the platform 2, and the hook 20 is released. Prior to withdrawal of the working rolls, however, the cylinders 3*b* which are generically illustrated as spacer means at 14 in FIG. 2, are depressurized to bring the working rolls together and permit them to move out of the gap 1*g* between the back-up rolls with ease.

Referring now to FIGS. 2 – 4 in somewhat greater detail, it will be apparent that the skid or slide **6** carries both working rolls. More particularly, the skid is constituted as a frame or cradle for the lower rolls and the lower rolls, in turn, carry the upper roll.

The slide or skid **6** comprises a pair of longitudinal runners **7**, the latter extending parallel to the axes of the working rolls **4** and in the direction in which the working rolls are shifted for introduction into and removal from the mill. Of course, the runners **7** lie in a horizontal plane but perpendicular to the direction of rolling. Each of the runners **7** is provided with a downwardly extending ridge **7***a* of narrow dimension for engagement with the platform **2** and the table **1***h* to reduce frictional retardation during insertion and withdrawal of the slide. The leading edge **7***b* and the trailing edge **7***c* of the ridge is beveled to facilitate transition between platform **2** and table **1***h* upon movement of the skid in either direction. The runners **7** are interconnected by traverses **8** such that a rectangular frame structure is provided. In FIG. **3** we show how the runners **7** are received within rectangular notches **3***g* of the bearing blocks **3***a*.

The frame **7**, **8** is made up of hollow (tubular) profiles that are interconnected into a common duct work or space **9** forming part of the hydraulic system for pressurizing the cylinders **14**. For this purpose, the skid **6** is provided with at least one bore into which a right-angle high-pressure plug-type quick-release connector half **11** is threaded, the member **11** being engageable in a complementary member (not shown) in a stand (preferably on the driving side) of the rolling mill. The high-pressure quick-release coupling **11** is made and disconnected automatically upon insertion of the skid and its withdrawal by the means **5**. The duct work **9** is further connected via bores **12** in slide **6** and connecting conduits **13** to the cylinders **14** of the bearing blocks **3**. Thus, when hydraulic fluid is fed under pressure through the coupling **11**, the working rolls **4** are urged apart and the gap **4***g* is thereby adjusted. Upon release of the pressure, the rolls are destressed and removal is possible.

The improvement described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the invention except as limited by the appended claims.

We claim:

1. A rolling-mill installation comprising:

a rolling-mill stand for the rolling of a workpiece in a rolling direction, said stand defining a receiving surface alongside the rolling path, said stand having a pair of spaced-apart backing rolls; a platform shiftable in said direction alongside said stand and having an upper surface substantially aligned with said receiving surface;

a work-roller assembly receivable in said stand between said backing rolls and including a skid slidable along said surface and formed with an opening, a lower working roll carried by said skid, and an upper working roll carried by said lower working roll, at least one hydraulic duct in said skid, and

means for connecting said duct into a hydraulic network, said lower working roll engaging its backing roll through said opening in said skid, said upper and lower working rolls are each provided with a pair of bearing blocks;

means for shifting said assembly from said platform onto said receiving surface and into said stand; hydraulic cylinders in the bearing blocks of said lower working roll acting upon the bearing blocks of the upper working roll for establishing a gap between them; and

means for connecting said duct to said cylinders.

2. The rolling-mill installation defined in claim **1** wherein said means for connecting said duct to said network includes a high-pressure quick-release plug-type connector carried by said slide and automatically insertable into and releasable from a complementary connector on said stand upon displacement of said assembly into and out of said stand respectively.

3. The rolling-mill installation defined in claim **2** wherein said skid is formed with a hook-shaped portion projecting beyond said working rolls and engageable by said means for shifting said assembly.

4. The rolling-mill installation defined in claim **3** wherein said runners and said traverses are hollow-profile members communicating with one another to form a common space defining said duct.

5. The rolling-mill installation defined in claim **4** wherein said stand forms part of the mill for rolling strip or band metal.

6. The rolling-mill installation defined in claim **5** wherein said platform is formed with wheels, said installation further comprising a guide way rollingly engaged by said platform alongside said path.

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