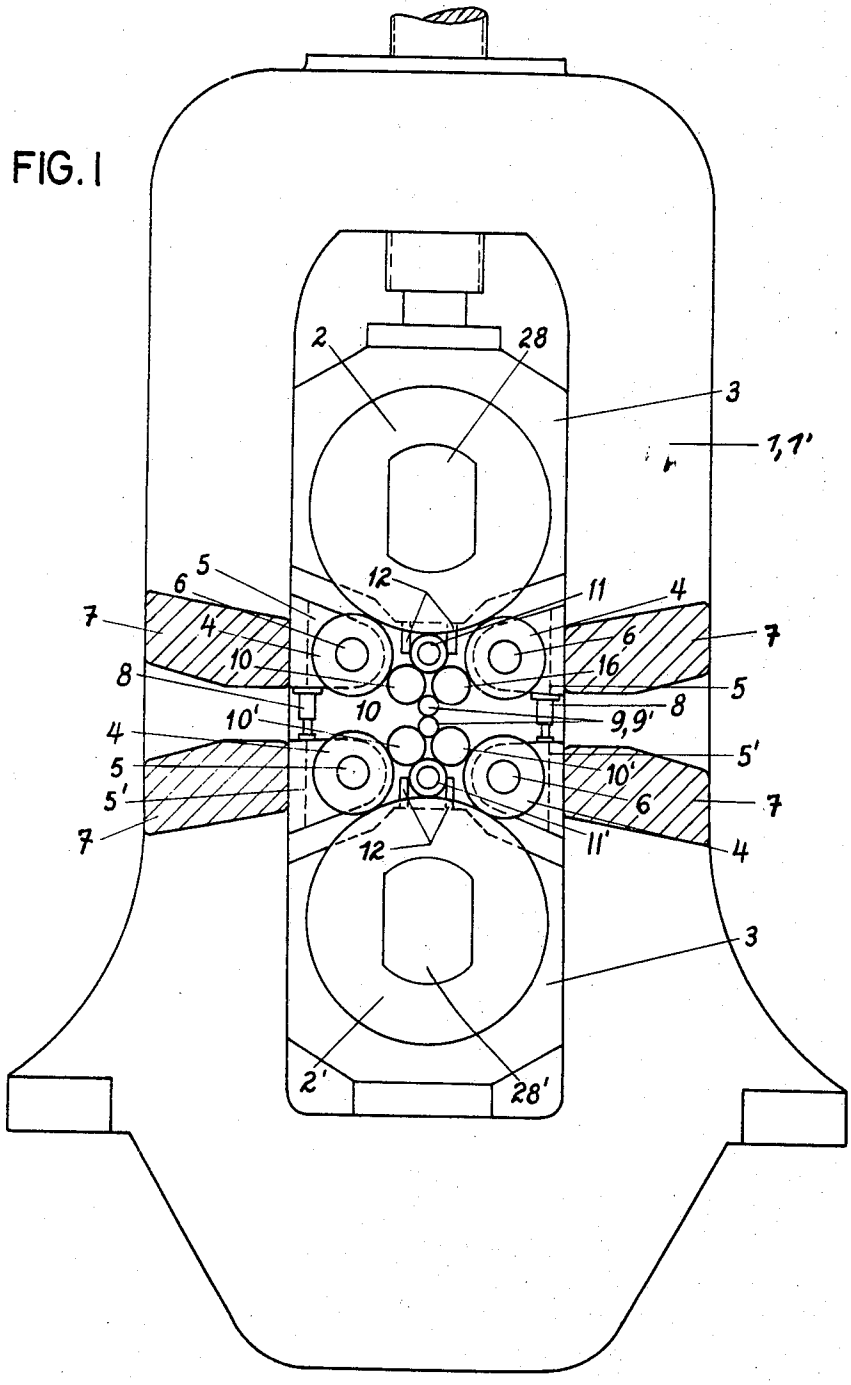
March 19, 1968 H. J. KNAPPE 3,373,590

MULTI-ROLL STANDS FOR THE COLD-ROLLING OF THIN, HARD STRIPS

Filed June 14, 1965 5 Sheets-Sheet 1

FIG. 1

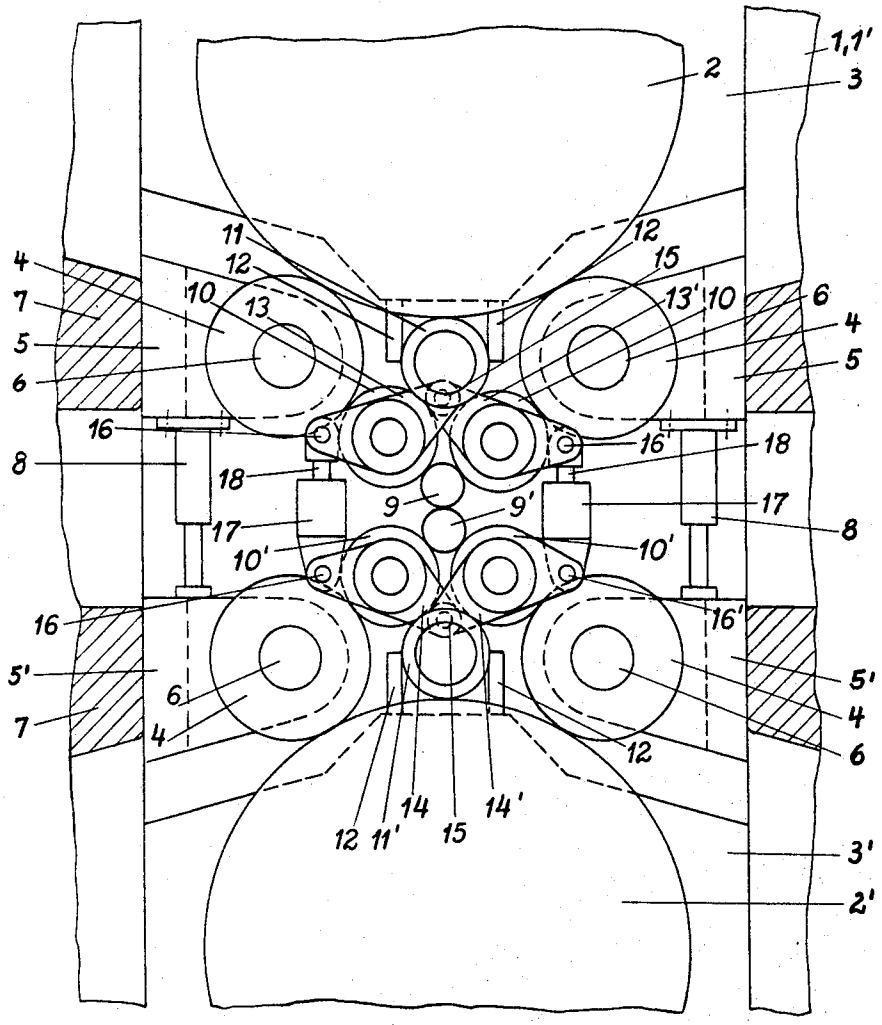


March 19, 1968 H. J. KNAPPE 3,373,590

MULTI-ROLL STANDS FOR THE COLD-ROLLING OF THIN, HARD STRIPS

Filed June 14, 1965 5 Sheets-Sheet 2

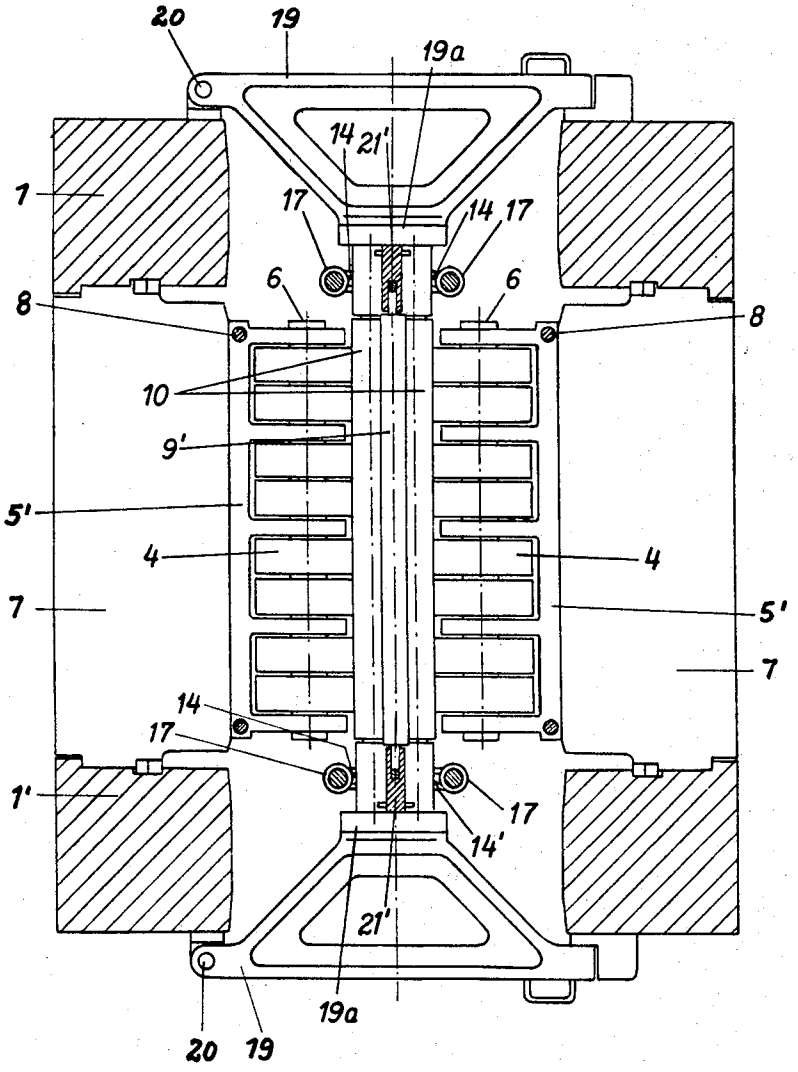
FIG. 2



MULTI-ROLL STANDS FOR THE COLD-ROLLING OF THIN, HARD STRIPS

Filed June 14, 1965 5 Sheets-Sheet 3

FIG. 3

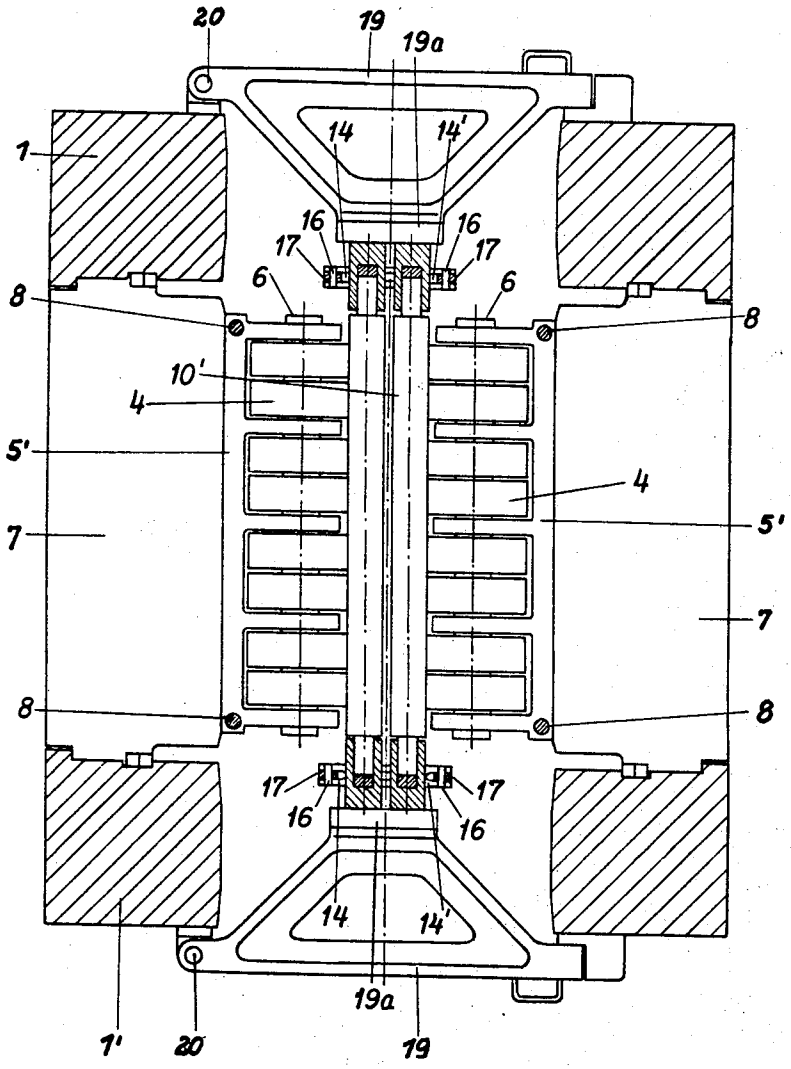


March 19, 1968 H. J. KNAPPE 3,373,590

MULTI-ROLL STANDS FOR THE COLD-ROLLING OF THIN, HARD STRIPS

Filed June 14, 1965 5 Sheets-Sheet 4

FIG. 4

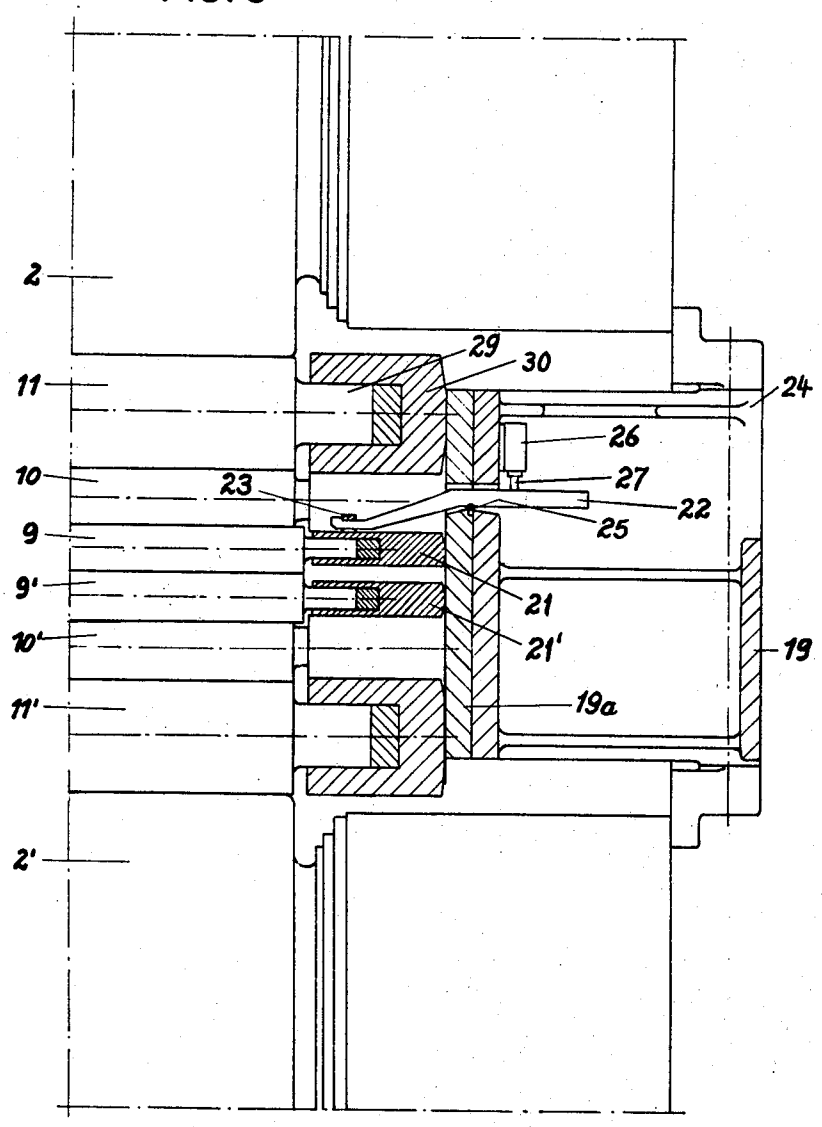


March 19, 1968 H. J. KNAPPE 3,373,590

MULTI-ROLL STANDS FOR THE COLD-ROLLING OF THIN, HARD STRIPS

Filed June 14, 1965 5 Sheets-Sheet 5

FIG. 5



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MULTI-ROLL STANDS FOR THE COLD-ROLLING OF THIN, HARD STRIPS

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Claims priority, application Austria, June 23, 1964, A 5,396/64
3 Claims. (Cl. 72—243)

ABSTRACT OF THE DISCLOSURE

A multi-roll stand for the cold-rolling of thin, hard strips with an upper backing roll and a lower backing roll provided with driving means, two sets of upper supporting rollers and two sets of lower supporting rollers journalled on lateral supporting girders, with each of the supporting rollers bearing against one of the backing rolls for the frictional transmission of power, two upper intermediate rolls arranged between the two upper sets of supporting rollers and two lower intermediate rolls arranged between the two sets of lower supporting rollers, upper and lower reversing rolls bearing on the upper and lower backing rolls respectively and on the two upper and two lower intermediate rolls respectively, and two working rolls, one upper and one lower, each supported and frictionally driven by two of the intermediate rolls.

This invention relates to a multi-roll stand, for the cold-rolling of hard, thin strips. In rolling such stock, as is known, an appreciable reduction per pass is attainable only with working rolls of extremely small diameter. Since the cross section of these small working rolls would no longer suffice for the transmission of the requisite torque, and the roll pressure would cause considerable deflection, the working rolls are supplemented by backing rolls, which support the working rolls on their roll bodies, and transmit the driving power to the working rolls by peripheral friction.

This driving by peripheral friction produces, on the working rolls, a horizontal force opposite to the direction of rolling, which leads to a deflection of the working rolls. In order to take up these forces, in one known roll stand, the working rolls are each accommodated between two intermediate rolls, which in their turn find support on a ring of backing rolls. This roll stand, and the roll stand further developed therefrom by the provision of a second ring of backing rolls in the form of supporting rollers, permits the employment of extremely small rolls. A disadvantage common to both resides in the fact that these roll stands, on account of the numerous rolls and their bearings, allow only a small adjustment path. They require a wide housing window, which precludes the insertion into a normal quarto stand. They are therefore purely single-purpose roll stands, in which conversion to rolling on another principle is not possible.

Attempts have therefore already been made, by providing a single backing roll, upon which the intermediate rolls that hold the working roll bear, to simplify such multiple roll stands. This, however, did not lead to any success, since in this way the greater part of the roll pressure is taken up by the bearings of the intermediate rolls, and is accordingly no longer available, in the case of positively driven backing rolls, as application pressure for the driving by peripheral friction.

In another construction the working rolls are shifted out of the plane of the backing rolls, and, in the direction of this dispalecement, by way of intermediate rolls, are held by supporting rollers journalled on rigid supporting

beams and bearing on the backing rolls. In this way the driving torque is transmitted to the working rolls both directly by the backing rolls and also by way of the supporting rollers and the intermediate rolls by peripheral friction, the intermediate rolls serving as reversing rolls. This method of construction does not permit the use of extremely thin working rolls, on account of the requisite minimum size of the supporting rollers.

The object of this invention is, in the case of a roll stand with an upper and a lower positively driven backing roll, and with supporting rollers journalled on lateral supporting beams and bearing in each case on a backing roll, to provide the possibility of employing exceedingly thin working rolls, while ensuring sufficient transit space for the stock that is being rolled.

To attain this object, according to the invention, between the upper and lower supporting rollers, two intermediate rolls are in each case provided, which bear, on the one hand, against the supporting rollers, and, on the other hand, through a reversing roll in each case, against the upper or lower backing roll, and which in their turn support the working rolls, the working rolls being in power-transmitting frictional contact with the positively driven backing rolls by way of the intermediate rolls, and on the one hand the supporting rollers and on the other hand the reversing rolls.

By the provision of reversing rolls it becomes possible, for the frictional transmission of the driving torque from the backing rolls by way of the supporting rollers, reversing rolls and intermediate rolls to the working rolls, to maintain sufficient application pressures between the backing rolls, supporting rollers, reversing rollers, intermediate rolls and working rolls, and to reduce the diameter of the intermediate rolls that hold the working rolls to such an extent that extremely thin working rolls can be employed.

A rolling device has indeed already become known in which each two intermediate rolls and one reversing roll are supported in each case against one outer backing roll. In this case at least two of the backing rolls have to be provided with a drive of their own, so that the fitting in of the set of rolls between the backing rolls of a normal quarto roll stand, and the change-over to a different principle of rolling, is precluded. The roll stand according to this invention can on the contrary be changed, by putting in a different set of rolls, into a two-high stand, or can be changed in some other way.

A roll stand has also already been proposed in which two working rolls are each supported by two intermediate rolls bearing perpendicularly against a driven backing roll, these intermediate rolls bearing approximately horizontally, by way of a reversing roller, on a series, in each case, of supporting rollers, journalled in a rigid supporting beam. One disadvantage of this roll stand resides in the fact that on account of the linear arrangement of the intermediate rolls, reversing rolls and supporting rollers, only a limited amount of wear of the same is admissible. In the event of the wear becoming too great, the gap between the intermediate rolls would become too wide, and a jamming of the working roll would therefore occur. Moreover the transit space for the stock is greatly restricted, which makes it difficult to arrange the guide plates and the supply of cooling medium.

The construction according to the invention presents however a considerably greater transit space. Instead of two lateral reversing rolls, only one central reversing roll is required, which has three-fold support on its body. By this arrangement the gap between the intermediate rolls, even with increasing wear, can be kept constant, or even reduced, by diminishing the diameter of the reversing roll.

In a further development of the invention, the journals

of the reversing rolls are fixedly located with their bearing sleeves, between lugs arranged upon the chocks, in a horizontal direction.

According to a further feature of the invention, to each of the bearing sleeves of the upper working roll is secured a two-armed lever, the fulcrum of which is located in a recess in the axial bearing member of the working and backing rolls, the piston rod of a cylinder secured to the said axial member and connected to a source of pressure fluid being directed from above on to the other arm of the lever. In this way the upper working roll, even after the rolled stock has run out, is kept in contact with the upper intermediate rolls.

One constructional example of the present invention is illustrated in the accompanying drawings, in which:

FIGURE 1 shows a side view of a roll stand with an arrangement of rolls according to this invention;

FIGURE 2 shows a portion of the side view, with details of the supporting of the rolls, on a larger scale;

FIGURE 3 shows a horizontal section of the roll stand in the axial plane of the working rolls;

FIGURE 4 shows a horizontal section in the axial plane of the intermediate rolls; and

FIGURE 5 shows details of the holding means for the working rolls.

In the window apertures of two roll-stand housings **1**, **1'** are journalled, in chocks **3**, **3'**, two backing rolls **2**, **2'** which are driven by way of their necks **28** and **28'**. On the bodies of the backing rolls **2**, **2'** are bearingly arranged supporting rollers **4**, which are supported upon spindles **6** on comb-like girders **5**, **5'**, which are displaceably mounted on supporting bridges **7** connecting the housings **1** and **1'**.

Between the upper and lower girders **5**, **5'** are vertically arranged cylinders **8**, with pistons, which, when actuated by a pressure fluid, ensure a frictional driving contact of the supporting rollers **4** with the backing rolls **2**, **2'**.

On the supporting rollers **4** there bear two upper and two lower intermediate rolls **10**, **10'** with frictional driving contact, supporting and driving on their bodies an upper and a lower working roll, **9** and **9'** respectively, the upper and lower pairs of the intermediate rolls **10**, **10'** finding a secure hold, by way of a reversing roll **11**, **11'** in each case, on the backing rolls **2** and **2'** respectively. The reversing rolls **11**, which are provided on their journals with bearing sleeves **30**, which are secured horizontally between lugs **12** on the chocks **3** and **3'**.

The intermediate rolls **10** and **10'** are supported by their journals in levers **13**, **13'** and **14**, **14'**, which are pivotally connected in pairs by bolts **15**. The opposite free ends of in each case an upper and a lower lever, **13** and **14** or **13'** and **14'**, are connected by bolts **16**, **16'** with cylinders **17** and with their piston rods **18**. By hydraulic or pneumatic actuation of the piston rods **18** the upper and lower levers **13** and **14** or **13'** and **14'** are pushed asunder, which leads to a spreading of the upper and lower pairs of levers **13**, **13'** and **14**, **14'**, and therefore to a firm bearing of the intermediate rolls **10**, **10'** on the supporting rollers **4**, and on the upper and lower reversing rolls **11**, **11'**.

The reversing rolls **11**, **11'**, intermediate rolls **10**, **10'** and working rolls **9**, **9'** are in an axial direction located by the front plate **19***a* of a yoke **19**, which is rockably supported in bearing eyes **20** on the housing **1**, **1'**.

In order to maintain the upper working roll **9** always in contact with the intermediate rolls **10**, levers **22** (FIGURE 5) are accommodated on each of their bearing sleeves **21**, in an eye **23**. These levers extend through an aperture **24** in the front plate **19***a* of the yoke **19** into the interior of the yoke, and are rockable about a bearing point **25** in the aperture. The piston of a cylinder **26** secured perpendicularly on the inside of the front plate **19***a* when

supplied with pressure fluid, presses, by way of a piston rod **27**, upon that arm of the lever **22** which projects into the interior of the yoke **19**, whereby its other arm, with the bearing sleeve **21** and the working roll **9**, is lifted.

For the exchanging of the working rolls **9**, **9'**, first of all the lever **22** is removed. Then, after the yoke **19** has been rocked outwards, the working rolls **9**, **9'** can be taken out. For the bearing sleeves **21'** of the lower working roll **9'**, a holding appliance such as the lever **22** is not required.

The set of rolls consisting of the supporting rollers **4**, the intermediate rolls **10**, **10'**, the reversing rolls **11**, **11'** and the working rolls **9**, **9'**, is exchangeable in a simple manner for two quarto rolls.

I claim:

1. A multi-roll stand for the cold-rolling of thin, hard strips, comprising: housings formed with window apertures, upper and lower chocks accommodated in the said window apertures, a positively driven upper backing roll journalled in the upper chocks, a positively driven lower backing roll journalled in the lower chocks, lateral girders mounted in the housings, two sets of upper supporting rollers journalled on some of said lateral girders and bearing against the upper backing roll, two sets of lower supporting rollers journalled on other of said lateral girders and bearing against the lower backing roll, two upper intermediate rolls arranged between raid two sets of upper supporting rollers each respectively bearing on said upper supporting rollers of each set, two lower intermediate rolls arranged between said two sets of lower supporting rollers each respectively bearing on said lower supporting rollers of each set, an upper reversing roll bearing directly on the upper backing roll and also on both the upper intermediate rolls, and a lower reversing roll bearing directly on the lower backing roll and also on both the lower intermediate roll so that each of the intermediate rolls is frictionally driven from the backing roll through a reversing roll and also through one set of supporting rollers, an upper working roll in frictional driving contact with the two upper intermediate rolls, and a lower working roll in frictional driving contact with the two lower intermediate rolls.

2. A multi-roll stand as claimed in claim **1**, further comprising: journals on the upper and lower reversing rolls, bearing sleeves engaging the said journals, and lugs on the upper and lower chocks adapted to check horizontal displacement of the said bearing sleeves and journals.

3. A multi-roll stand as claimed in claim **2**, further comprising: bearing sleeves for the upper working roll, a two-armed lever secured to each of these bearing sleeves, front plates bearing against the bearing sleeves engaging the journals of the working rolls and thereby limiting axial displacement of the working rolls, these front plates each being formed with an aperture through which the associated two-armed lever passes and in which it is fulcrumed, and a fluid-pressure cylinder-and-piston unit mounted on each front plate and acting on the associated two-armed lever.

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