Feb. 2, 1971 H. LEMPER ET AL 3,559,441

ROLL CHANGING DEVICE FOR ROLL LEVELER, STRAIGHTENER AND THE LIKE

Filed Nov. 1, 1968 3 Sheets-Sheet 1

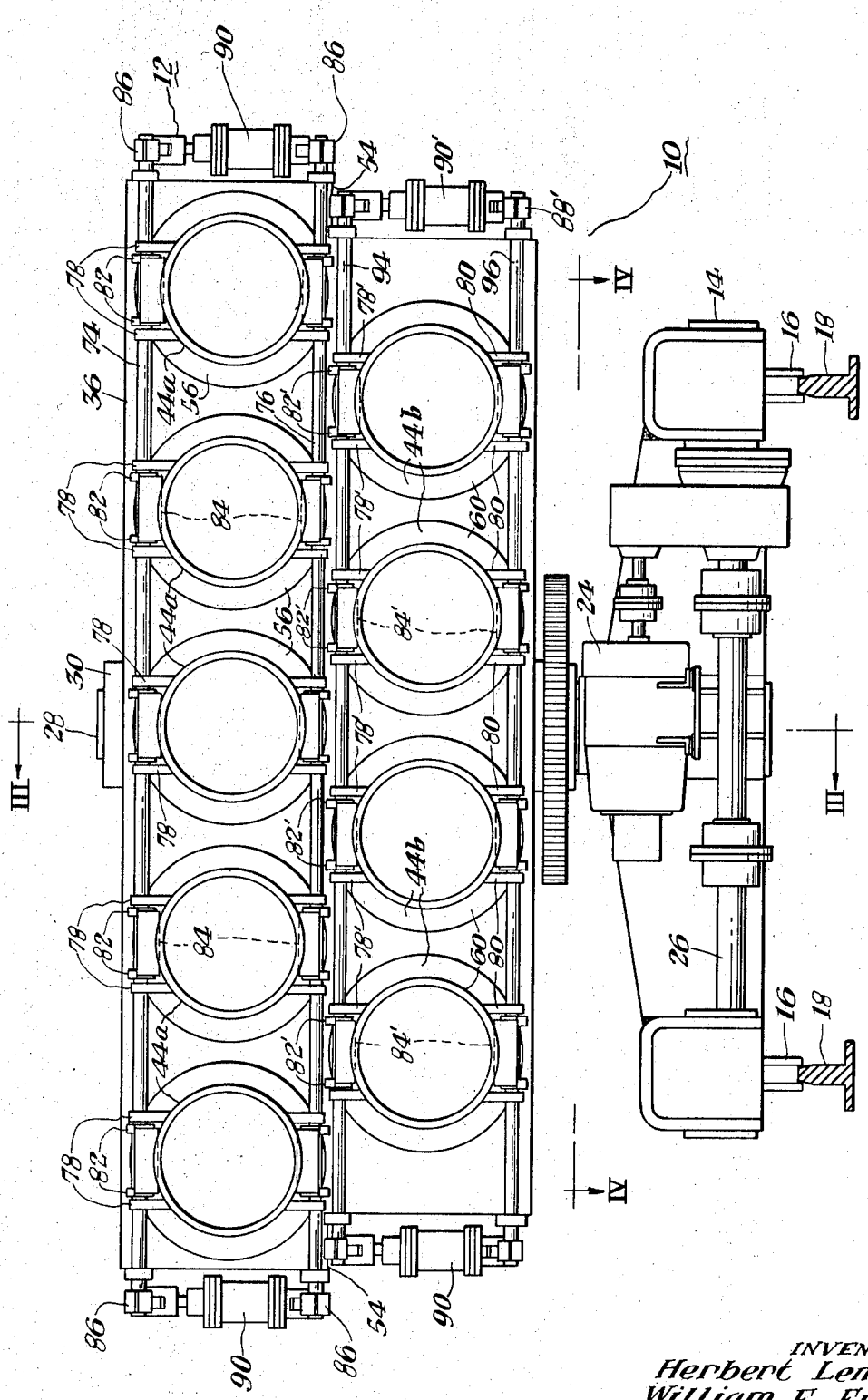


Fig. 1.

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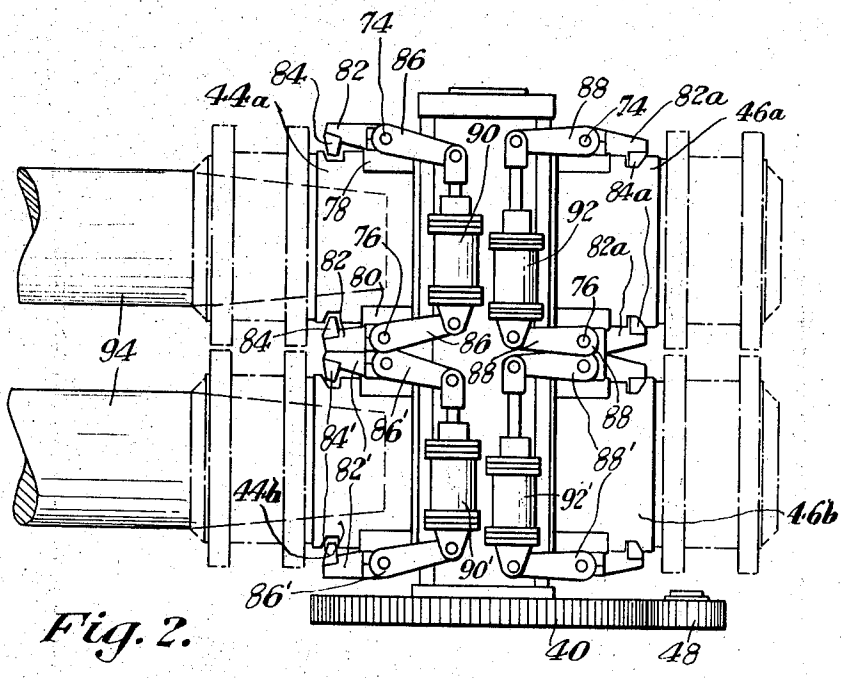


Fig. 2.

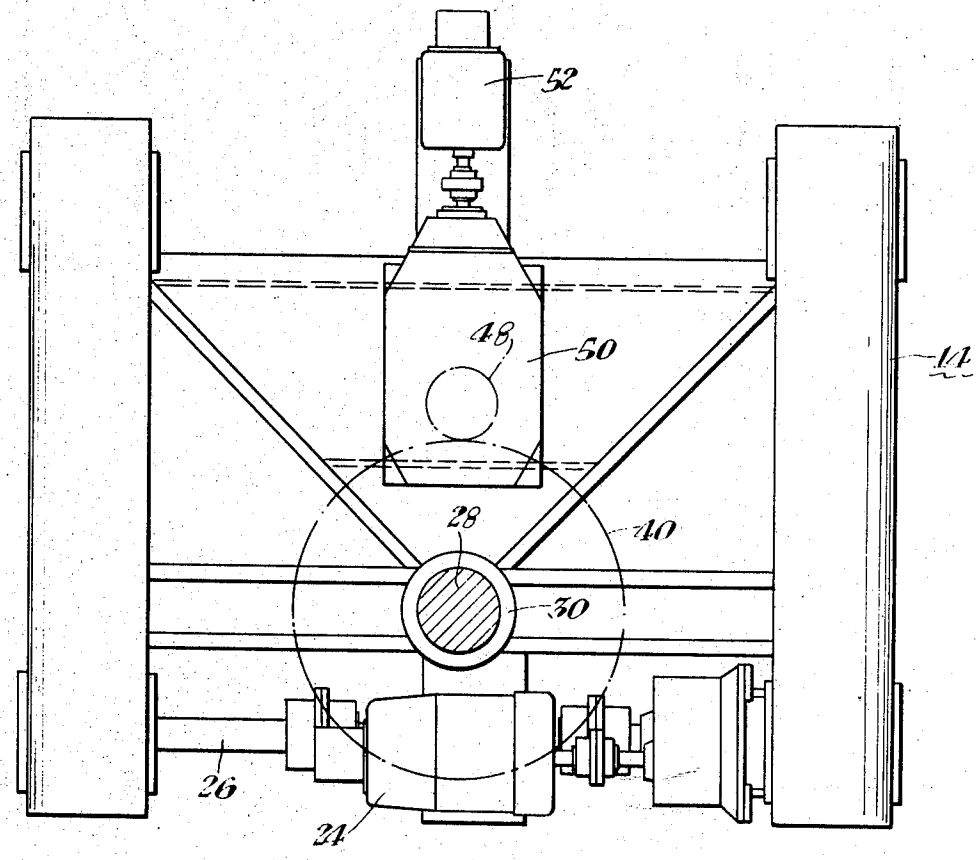


Fig. 4.

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ROLL CHANGING DEVICE FOR ROLL LEVELER, STRAIGHTENER AND THE LIKE

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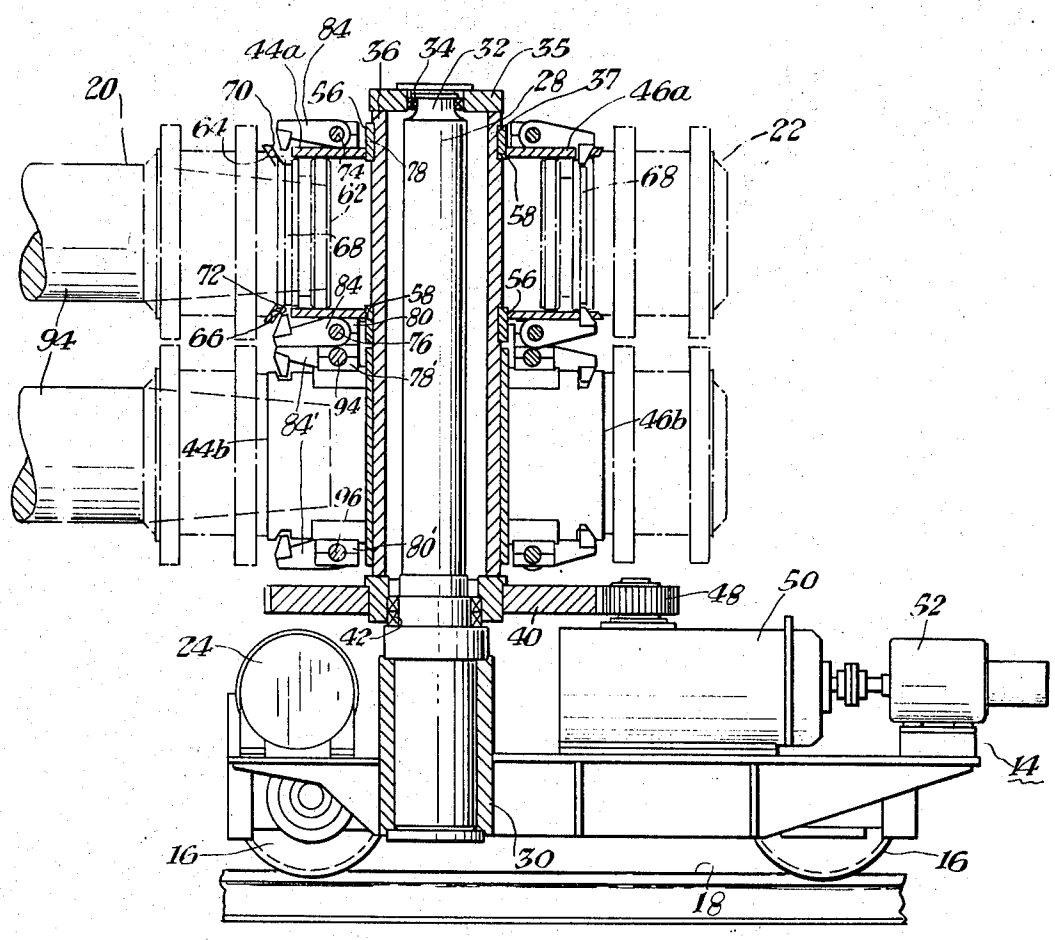


Fig. 3.

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ROLL CHANGING DEVICE FOR ROLL LEVELER, STRAIGHTENER AND THE LIKE

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Int. Cl. B21b 31/08
U.S. Cl. 72—239 10 Claims

ABSTRACT OF THE DISCLOSURE

We disclose a roll changing device for a roll straightener and the like, said device comprising a support structure, a plurality of tubular sockets shaped to receive respectively portions of the rolls normally mounted on said straightener, means for mounting said sockets in a predetermined array on said support and in alignment with said straightener, and clamping means mounted on said support for each of said sockets for clamping said rolls respectively therein.

The present application is an improvement upon the copending, co-assigned application of Joseph Hlafcsak entitled Roll Changing Device, filed concurrently herewith Ser. No. 772,722.

The present invention relates to roll changing means for a roll leveler, straightener, the like, and more particularly to means of the character described for changing the rolls of a roll straightener or leveler simultaneously.

As sometimes used herein the terms "leveler" or "roll leveler" is inclusive also of similar straightener devices and equivalent apparatus.

Structural mill straighteners or levelers are employed throughout the steel and related industries for straightening various structural shapes such as beams and angles, and for leveling strip or sheet. Such devices employ usually a large number of rolls, with seven or more such rolls being common. In practice, the rolls of the leveler or straightener must be changed to accommodate each shape or size of product to be leveled. Frequent roll changes are, therefore, required.

At the present time, each of the rolls is individually and successively changed by means of a crane, a troublesome and time-consuming operation. The new or replacement rolls must be handled in a similar, one-at-a-time fashion, which aggravates the situation. As the rolls are subject to severe wearing forces, roll changes for maintenance purposes common are, in addition to the aforementioned productional changes.

It would be difficult indeed to overstate the difficulties and hazards involved in making these roll changes in accordance with present practices. The heaviest rolls presently used in straightener devices weigh as much as 3,300 pounds and more. The dangers inherent in moving articles of this size and weight, particularly with overhead cranes, are immediately apparent. In addition to the considerable personnel hazard and the possibility of roll damage by careless handling, the downtime and loss of production entailed in conventional roll-changing operations is far from negligible.

We overcome these disadvantages of the prior art by providing a roll-changing device capable of removing and replacing leveler rolls in simultaneous operations respectively. Our roll-changing device supports the replacement rolls thereon in a predetermined array and receives the rolls from the straightener or leveler in a similar array. Thus, the changing device can be moved to a first position at which the rolls of the leveler or straightener are engaged and removed simultaneously. The roll-changing device is withdrawn from leveler to remove the rolls from their individual shafts. Subsequently, the changing device is again advanced, but in a different attitude, to the leveler to slip new rolls stored on the changing device onto the vacated shafts of the leveler. With arrangement, the leveler rolls can be changed in a matter of minutes. The hours of downtime of previous practices are avoided, together with the attendant personnel hazard, equipment damage, and losses in production.

At the same time, the hazards involved in moving the massive rolls about the plant are eliminated. The changing device, besides its operation in simultaneously removing and replacing the rolls, can be used for conveniently transferring the groups of new and used rolls between the leveler or straightener and a convenient storage area.

These desirable ends are accomplished admirably by the roll changing device of the aforementioned copending application in many applications. Our roll changing device, however, shortens the time consumed in the roll changing operation still further. For example, our changing device can be more readily adjusted for use with variable pitch roll levelers. Alignment of the roll changing device with the rolls of the straightener or leveler is facilitated by the provision of improved clamping means in addition to moving the device toward and away from the straightener or leveler. Finally, we employ a fail-safe locking or clamping device for the rolls supported on the roll changing device to reduce personnel hazards.

We accomplish these desirable results by providing a roll changing device for a roll straightener and the like, said device comprising a support structure, a plurality of tubuar sockets shaped to receive respectively portions of the rolls normally mounted on said straightener, means for mounting said sockets in a predetermined array on said support and in alignment with said straightener, and clamping means mounted on said support for each of said sockets for clamping said rolls respectively therein.

We also desirably provide a similar roll changing device wherein a second array of roll receiving sockets is mounted in alignment with said straightener rolls on the other side of said support.

We also desirably provide a similar roll changing device wherein at least the clamping means associated with the movable sockets are mounted entirely on said movable sockets for movement therewith.

During the foregoing discussion, various objects, features and advantages of the invention have been set forth. These and other objects, features and advantages of the invention together with structural details thereof will be elaborated upon during the forthcoming description of presently preferred embodiments of the invention and presently preferred methods of practicing the same.

In the accompanying drawings we have shown certain presently preferred embodiments of the invention and have illustrated presently preferred methods of practicing the same wherein:

FIG. 1 is a front elevational view of one form of roll changing device arranged in accordance with our invention;

FIG. 2 is a partial side elevational view of the changing device shown in FIG. 1;

FIG. 3 is a vertically sectioned view of the device as shown in FIG. 1 and taken along reference line III—III thereof; and

FIG. 4 is a horizontally sectioned view of the device as shown in FIG. 1 and taken along reference line IV—IV thereof;

With reference more particularly to the drawings, roll changing device **10** shown therein has been evolved for use with a roll straightener or the like such as that illustrated in the aforementioned copending application. In this arangement then, the roll changing device **10** includes

a support 12 pivotally mounted upon a wheel supported base structure or carriage 14. The carriage 14 in this example is equipped with suitable railway type wheels 16 for movement along a pair of rails 18 (FIG. 1). The rails 18, as illustrated in the aforementioned copending application, are aligned with the roll straightener (not shown herein) with which the device 10 is utilized so that upon movement of the roll changer 10 toward and away from the roll straightener an array of rolls 20 or 22 supported thereon is aligned with an array of supporting shafts therefor on the roll straightener.

In the illustrated form of our invention, the carriage 14 is self-propelled and is furnished with drive motor 24 coupled to a wheel-supported output shaft 26 for driving the associated pair of wheels 16. For the purpose of presenting either side of the pivoted support 12 as the roll changer 10 is advanced and withdrawn from the area immediately in front of the roll straightener the support 12 is mounted for pivotal movement about a vertical pivot axis, which corresponds to the axis of vertical pivot post 28. The lower end of the pivot post 28 is stationarily mounted in socket 30 supported on the carriage 14.

The upper end of the pivot post 28 is journaled at 32 to receive radial bearing 34 mounted upon a bearing support block 35, which in turn is secured to the adjacent upper edge portions of a pair of supporting plates 36, 37 comprising the support structure 12. The supporting plates therefore extend longitudinally of the support structure 12, and their opposite lower edge portions rest upon hub 38 of spur gear 40 for rotation with the spur gear. The hub 38 is rotatably mounted upon the stationary pivot post 28 by means of thrust and radial bearing 42.

The entire support structure 12 can be pivoted to present the array of rolls 20 or 22 or the array of empty roll sockets 44 and 46 to the roll leveler. This is accomplished by drive pinion 48, gear reducer 50 and drive motor 52, all of which are mounted on the carriage 14. As evident from the several figures, the components associated with the pivoting of the support structure 12 are heavily constructed in order to support the accumulated weight of the arrays of rolls 20 and/or 22.

In correspondence with their arrangement of the roll leveler or the like as dictated by a specific application of our invention, each array of rolls 20, 22 (FIGS. 2 and 3) is divided into an upper row insertable in sockets 44*a* or 46*a* and a lower row insertable in the sockets 44*b* and 46*b*.

The upper rows of sockets 44*a*, 46*a* are secured in longitudinally spaced array along the respective upper portions of the supporting plates 36, 37, which are provided with longitudinal extensions 54 to afford the necessary length for this purpose. The lower rows of sockets 44*b*, 46*b* are mounted on the remaining portions respectively of the supporting plates 36, 37 and are similarly spaced along the length thereof.

Each of the upper rows of sockets 44*a*, 46*a* is secured to a mounting ring 56, seated in an annular countersink 58 and thereby properly and spacedly positioned along the upper portion of the associated supporting plate 36 or 37. On the other hand, each of the lower rows of sockets 44*b*, 46*b* is secured to retaining ring 60, which is in turn secured to the supporting plate 36 or 37 in a predetermined pitch orientation. Desirably, the pitch between the upper and lower rows of sockets 44*a*, and 44*b* or 46*a* and 46*b* and the number thereof are established for a given roll straightener or the like.

When utilizing our roll changing device 10 the arrays of rolls 20, 22 are inserted individually and respectively into sockets 44*a*, 44*b* and 46*a*, 46*b*, each of which is shaped to receive closely a hub extension 62 of the associated roll 20 or 22. The outer edges of the sockets are chamfered at 64 to engage complementary surfaces 66 of the associated rolls. At this position clamp groove 68 of each roll 20 or 22 becomes aligned with slots 70, 72 of the associated socket 44 or 46. A clamp mechanism which will now be described, is actuated to clamp the roll 20 or 22 in its socket.

The clamping mechanism for each upper roll of sockets 44*a*, 46*a* includes a pair of actuating rods 74, 76 coextending substantially with the length of the associated supporting plate 36 or 37 including the longitudinal extensions 54. The actuating rods are respectively and rotatably mounted in series of pillow blocks 78, 80, which are mounted in pairs upon the upper and lower surfaces of each of the sockets 44*a*, 46*a*. Thus, each pair of pillow blocks 78 or 80 are mounted adjacent the slots 70 or 72 of the associated socket and are spaced to accommodate a pair of arms 82, with a clamp block 84 secured therebetween. Each of the arms 82 is rigidly secured to the associated actuating rod 74 or 76 for rotary displacement therewith.

Each pair of actuating rods 74, 76 is subjected to rotary displacement by pairs of crank arms 86 or 88 secured to the ends respectively of the actuating rods (FIGS. 1 and 2). An operating cylinder 90 or 92 is coupled between the ends of each pair of arms 86 or 88 respectively. The torque forces imparted to the actuating rods 74, 76 are balanced over the individual lengths thereof by the use of operating cylinders 90 or 92 at each end thereof (FIG. 1).

When the clamping mechanism is operated, as illustrated by the positions of cylinders 92 and crank arms 88 in FIG. 2, the clamp arms 82*a* and blocks 84*a* are angularly displaced to protrude the leading edges of the clamp blocks 84*a* through the socket slots 70, 72 which are sized for this purpose (FIG. 2). The clamp blocks 84*a* (FIG. 3) then seat in the clamping groove 68 of the associated roll 20 or 22 to support the roll substantially immovably in the sockets in order to preserve the prealigned array of the rolls 20 or 22 relative to the sockets 44 or 46 and relative to the array of supporting shafts 94 of the roller straightener (not shown).

In a similar manner the clamping mechanism including actuating rods 94, 96; pillow blocks 78', 80'; and clamp arms and blocks 82', 84'; are actuated for the lower rows of sockets 44*b*, 46*b* by operating arms 86', 88' and actuating cylinder 90', 92'.

In the last-mentioned clamping mechanism the actuating rods 94, 96 are correspondingly shorter with reference to the lower portions of supporting plates 36, 37 such that the crank arms 86', 88' and cylinders 90', 92' are displaced inwardly of the crank arms 86, 88 and cylinders 90, 92 of the upper clamping mechanisms. This places the parts just enumerated in non-interfering positions when the operating cylinders 90, 92 or 90', 92' are actuated (FIG. 2).

From the figures and the foregoing description of the clamping mechanisms, it will be seen that the clamping mechanisms are mounted entirely and respectively on the associated rows 44*a*/46*b* of the sockets. This arrangement facilitates construction and utilization of the clamping mechanisms with a minimum of component parts. The pitch of the straightener (shaft portions 94), with which the changing device is utilized, is readily adjusted (by conventional means), if necessary, to insert the rolls into the sockets of the roll changing device 10.

In operation, the changing device is advanced to the roll straightener shafts 94 along rails 18. Initially, the rows of sockets 44*a*, 46*b* have been arranged in pitch to correspond to that of the straightener or conversely, in a variable pitch straightener, the pitch is varied to align the rolls with the sockets. The straightener rolls, for example the rolls 20, are inserted into the sockets 44*a*, 44*b* respectively near the end of the advancing stoke of the roll changing device 10. After the chamfered leading edges of the sockets engage the corresponding surfaces 66 of the roll 20, the aforedescribed clamping mechanisms on that side of the support structure 12 are actuated by operation of the respective cylinders 90, 90'.

The changing device **10** is then withdrawn sufficiently to remove the rolls **20** from the straightener shafts **94** and to permit pivoting of the support structure **12** about the pivot post **28**. When the support structure **12** is transversely realigned with the carriage **14** and with the face of the roll straightener, the changing device **10** is again advanced to slip the new or replacement rolls **22** on the opposite side of the support structure **12** onto the protruding shaft ends **94** of the roll straightener. The aforedescribed clamp mechanisms associated with the sockets **46***a*, **46***b* are then released and the roll changing device **10** is again withdrawn leaving the replacement rolls such as the rolls **22** upon the roll straightener. If desired, the changing device **10** can be further withdrawn to a suitable place of storage (not shown) where the array of used rolls **20** can be removed from the changing device.

From the foregoing it will be apparent that novel and efficient forms of roll changing devices have been described herein. While we have shown and described certain presently preferred embodiments of the invention and have illustrated certain presently preferred methods of practicing the same, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

We claim:

1. A roll changing device for use with apparatus utilizing a plurality of rolls, said device comprising a support structure, a plurality of tubular sockets protruding from said support structure and shaped to receive respectively portions of the rolls normally mounted on said apparatus, means for mounting said sockets in a predetermined array on said support and in alignment with said apparatus rolls, clamping members mounted entirely on said sockets for clamping said rolls respectively therein, and clamping member actuating means mounted on said support structure for actuating said clamping members.

2. The combination according to claim **1** wherein said clamping members are insertable respectively through slots in said sockets for engagement with complementary detent means formed on said inserted roll portions respectively to secure said rolls to said sockets.

3. The combination according to claim **1** wherein said actuating means include at least one rod rotatably mounted on said sockets, said clamp members being rigidly secured to said rod for rotary displacement therewith.

4. A roll changing device for use with apparatus utilizing a plurality of rolls, said device comprising a support structure, a plurality of tubular sockets protruding from said support structure and shaped to receive respectively portions of the rolls normally mounted on said apparatus, means for mounting said sockets in a predetermined array on said support and in alignment with said apparatus rolls, and clamping means mounted on said support for each of said sockets for clamping said rolls respectively therein, said clamping means including members insertable respectively through slots in said sockets for engagement with complementary detent means formed on said inserted roll portions respectively to secure said rolls to said sockets.

5. The combination according to claim **4** wherein a pair of said clamping members are mounted on diametrically spaced locations on each of said tubular sockets and are extendible through similarly located slots in each of said sockets for clamping engagement with the roll portions inserted therein.

6. A roll changing device for use with apparatus utilizing a plurality of rolls, said device comprising a support structure, a plurality of tubular sockets shaped to receive respectively portions of the rolls normally mounted on said apparatus, means for mounting said sockets in a predetermined array on said support and in alignment with said apparatus rolls, and clamping means mounted on said support for each of said sockets for clamping said rolls respectively therein, said clamping means including a pair of clamping mechanisms mounted on diametrically spaced locations on each of said tubular sockets and operable through similarly located slots in each of the sockets for clamping engagement with the roll portions inserted therein respectively, each of said clamping mechanisms including an actuating rod rotatably mounted on each of the associated sockets, and clamp members positioned respectively at said slots for insertion therethrough, said clamp members being rigidly secured to said actuating rod for rotary displacement therewith.

7. The combination according to claim **6** wherein a crank arm is secured to each end of each of said rods, and an expansible actuating mechanism is connected between the outward ends of each adjacent pair of said crank arms.

8. A roll changing device for use with apparatus utilizing a plurality of rolls, said device comprising a support structure, a plurality of tubular sockets shaped to receive respectively portions of the rolls normally mounted on said apparatus, means for mounting said sockets in a predetermined array on said support and in alignment with said apparatus rolls, and clamping means mounted on said support for each of said sockets for clamping said rolls respectively therein, said clamping means being insertable into at least one slot in each of said sockets for clamping engagement with the roll portions inserted respectively therein, said clamping means including at least one actuating rod rotatably mounted on said sockets, and clamp members positioned respectively at said slots for insertion therethrough, said clamp members being rigidly secured to said actuating rod for rotary displacement therewith.

9. A roll changing device for apparatus utilizing a plurality of rolls, said device comprising a support structure, a plurality of tubular sockets shaped to receive respectively portions of the rolls normally mounted on said apparatus, means for mounting said sockets in a predetermined array on said support and in alignment with said apparatus rolls, and clamping means mounted on said support for each of said sockets for clamping said rolls respectively therein, said sockets being arranged in rows, and means are provided for adjustably moving the sockets of at least one of said rows toward and away from the sockets of another of said rows to vary the pitch of said sockets for use with variable pitch roll apparatus.

10. The combination according to claim **9** wherein at least the clamping means associated with the movable sockets are mounted entirely on said movable sockets for movement therewith.

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