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Krumme

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[54] **ROLL CHANGING APPARATUS FOR A ROLLING MILL OR THE LIKE**

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

[51] **Int. Cl.²** **B21B 31/08**

[58] **Field of Search** 72/239, 238

[56] **References Cited**

UNITED STATES PATENTS

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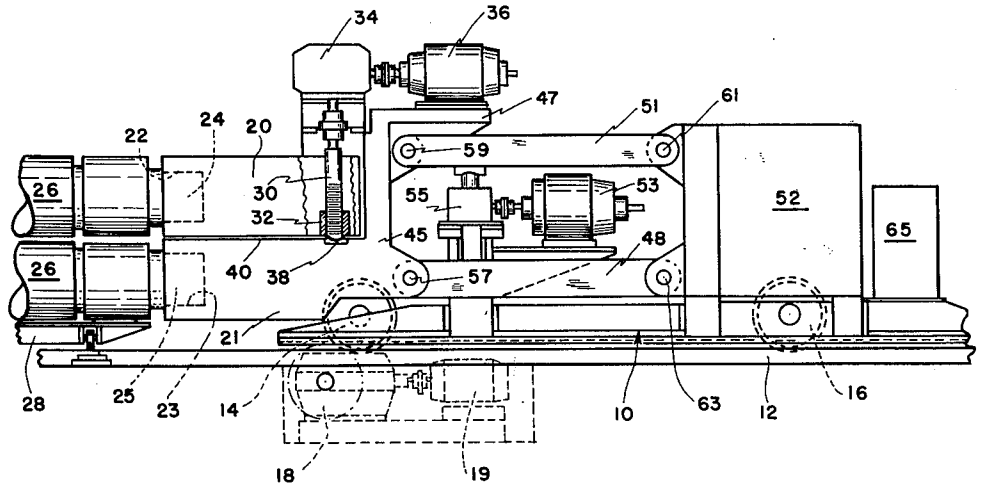
Attorney, Agent, or Firm—Daniel Patch; Henry C. Westin

[57] **ABSTRACT**

An apparatus related to a rail guided car located on the operator's side of a rolling mill for removing and replacing a set of work rolls relative to the mill by engaging the adjacent ends of the roll set. The car includes two members for supporting the rolls parallel to one another in a cantilever fashion and which can be readily and accurately adjusted for displacement either independently or in unison to align with varying roll centers. The car also includes a counterweight to offset the weight of the rolls as the rolls are adjusted and moved into and out of the mill.

5 Claims, 3 Drawing Figures



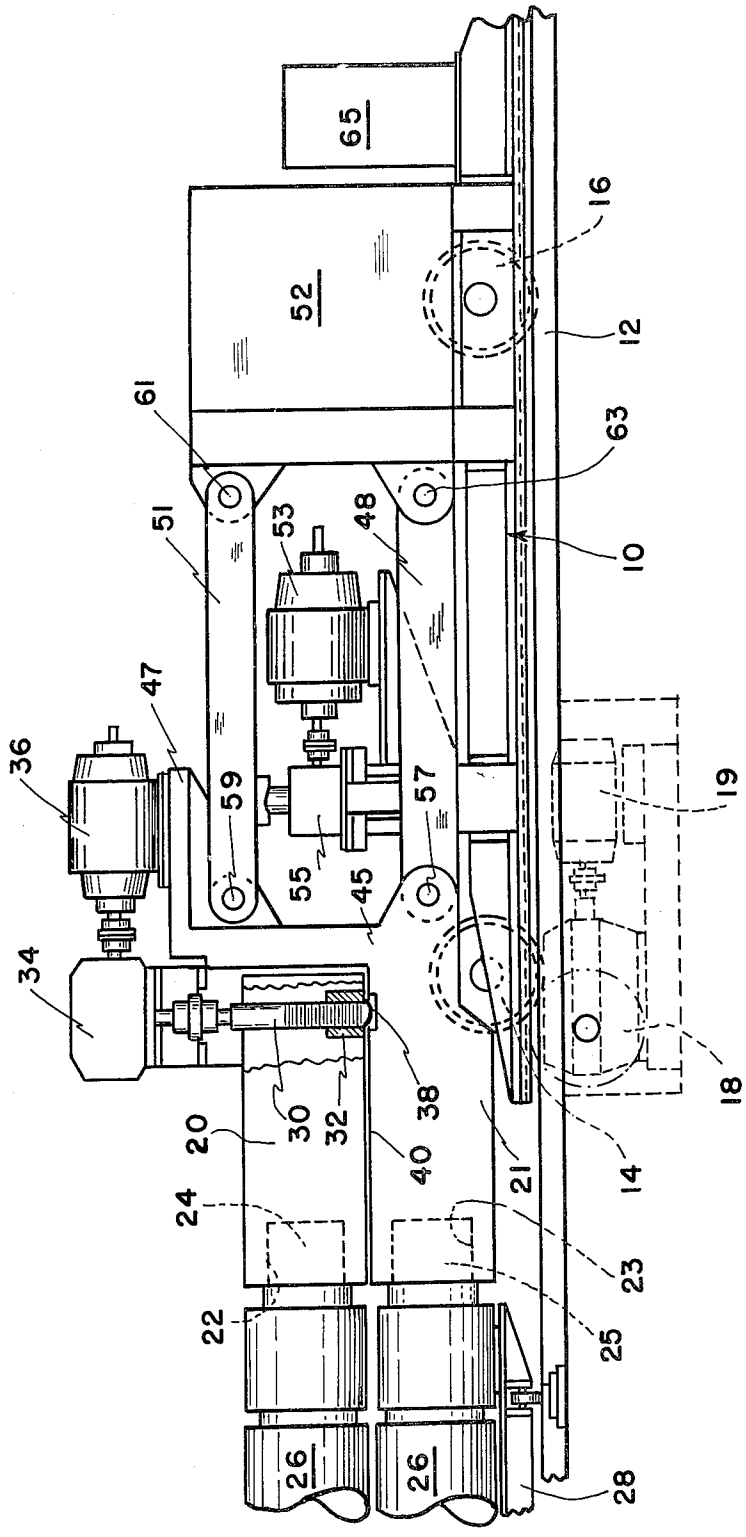

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FIG. 1

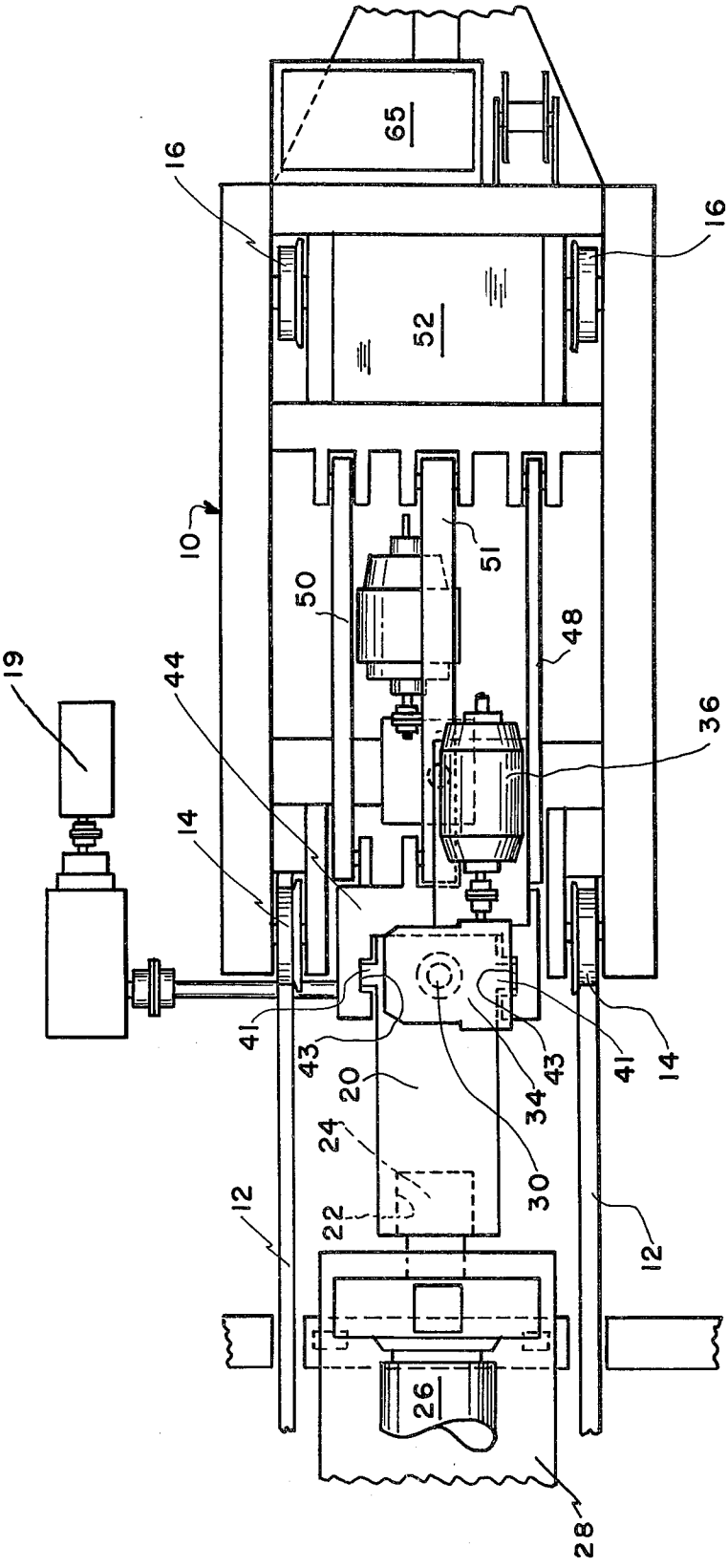
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FIG. 2

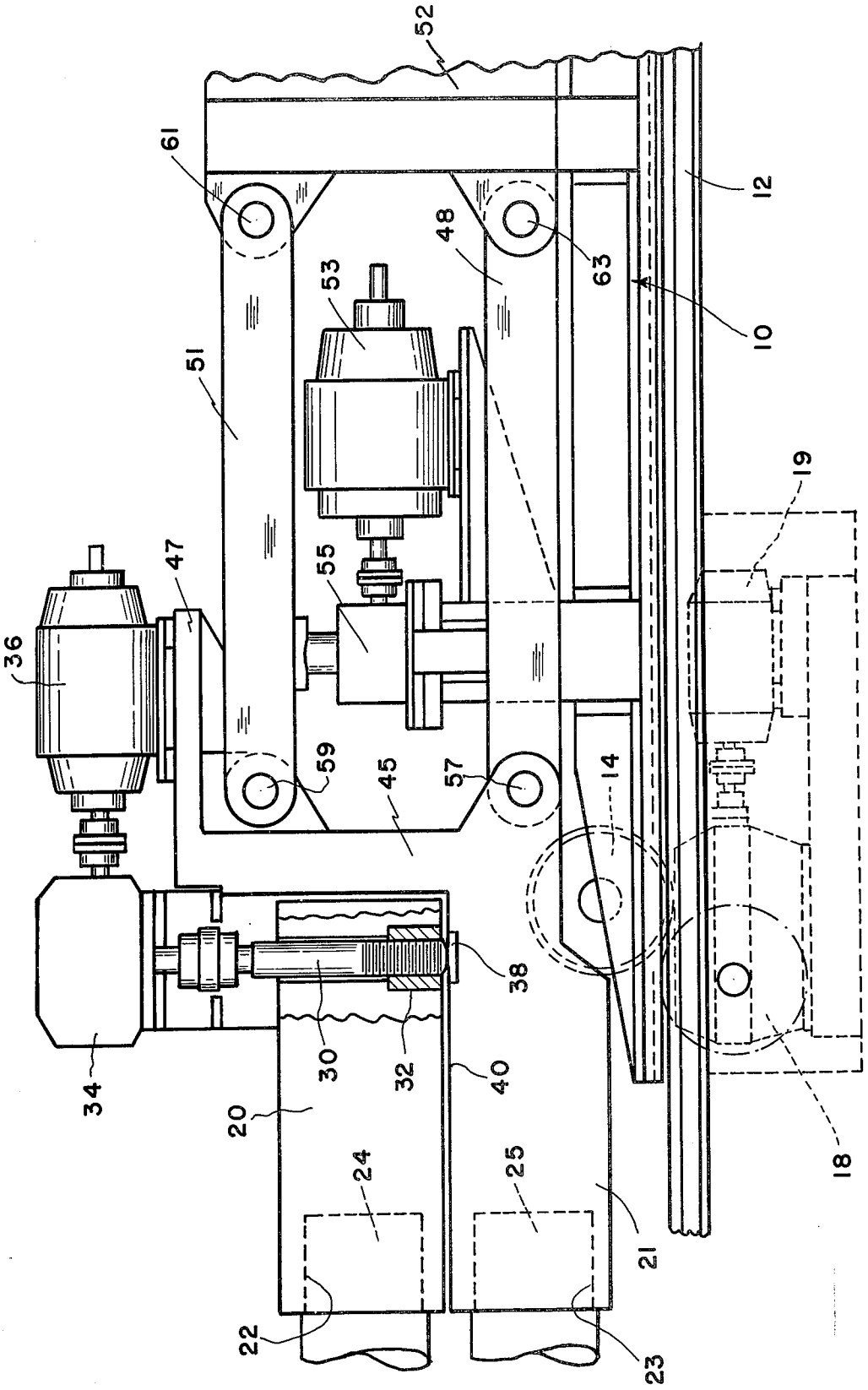
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FIG. 3

ROLL CHANGING APPARATUS FOR A ROLLING MILL OR THE LIKE

While automatic and very rapid work roll changing devices have been provided in many recent four-high rolling mills, many mills still employ porter bars or C-hooks to remove and replace the work rolls. Usually the rolls are removed one at a time, although porter bars are in use that remove and replace the rolls in pairs.

Porter bars and C-hooks require the services of a mill crane which is not only very time consuming and prevents the crane from being used for other necessary purposes, but makes accurate guiding and positive handling of the roll or rolls impossible. This results in not only substantial delay in properly positioning the rolls in the mill and aligning the rolls with the coupling of the driving spindles, but permits the rolls to be banged about resulting in damage to the mill parts and to the rolls themselves including the back-up rolls. In order to remove the rolls from the mill they are required to be lifted from the lower back-up rolls in a very limited space and when replaced they have to be lowered onto the lower back-up roll. In the past, during this operation very frequently the upper back-up roll was forcefully hit by the upper work roll and the lower back-up roll with the lower work roll resulting, in many cases, in damage to the rolls.

Notwithstanding the disadvantages of employing C-hooks or porter bars to change the work rolls, heretofore, not until very recently, this was the only option open to the industry other than the very expensive, fully automatic arrangements, such as turntables and sideshifters, used with push or pull work roll extractors. In addition to the very large initial capital expense when attempts were made to adapt them to existing mills, the automatic arrangements required substantial alteration to the mill; for example, a redesigning of the windows and bearing chocks to accommodate the extractors and the inclusion of roll supporting rails. More recently, a roll changing device has been proposed in which the roll supporting and carrying element has two fixed roll receiving portions and which necessitate the use of replaceable stools mounted between the chocks of the rolls when the rolls are in the mill.

With reference to the limitations and disadvantages of the above discussed devices employed to change rolls in the past, it is an object of the present invention to provide a device that will overcome each and every one in a very economical and highly dependable way.

It is, therefore, the object of the present invention to provide a device for changing one or more rolls of a rolling mill or like device which will not require the services of a crane or alterations to the mill or device itself and which will permit accurate, positive, and relatively rapid removal and replacement of the roll thereby eliminating any possible damage to the adjacent parts, including roll damage.

It is another object of the present invention to provide a guided roll carrying car located on the operator's side of the mill for removing and replacing a pair of rolls of the mill by engaging the ends of the rolls, said car including means for cantileverly supporting the rolls always parallel to one another which means can be readily and accurately adjusted for displacement either separately relative to one another or in unison to align

with varying roll centers, thereby eliminating the stooling operation in the mill.

A still further object of the present invention is to provide the aforesaid car with a counterweight to offset the weight of the rolls as the rolls are adjusted for displacement and moved into and out of the mill.

These objects, as well as other novel features and advantages of the present invention, will be better understood when the following description of one embodiment thereof is read along with the accompanying drawings of which:

FIG. 1 is an elevational view, partly broken away, of a roll carrying car constructed in accordance with the present invention arranged on the operator's side of a rolling mill showing the car in one of its operative positions;

FIG. 2 is an enlarged plan view of the car shown in FIG. 1; and

FIG. 3 is an enlarged view of the central portion of FIG. 2.

In referring first to FIG. 1, there is shown a work roll changing car **10** being supported on a pair of spaced parallel rails **12** arranged on the operator's side of a rolling mill, not shown, and which extends from a position remote from the window of the mill to a position adjacent thereto. The car engages the rails **12** by two pairs of wheels **14** and **16** and is driven by a rack and pinion arrangement **18**, which, in turn, is driven by a gear drive-electric motor assembly **19**. While the other important elements of the car **10** will be described later in connection with FIGS. **2** and **3**, sufficient at this point is to call attention to the roll carrying members **20** and **21** mounted on the front of the car **10**, each having an opening **22** and **23**, respectively, for receiving the adjacent end **24** and **25** of two work rolls **26** of a rolling mill for cantileverly supporting the rolls as a set during exchange of the rolls to and from the mill. To the left of the car **10**, as one view FIG. **1**, only a small portion of the set of rolls **26** supported by a platform **28** of a side-shifting device is shown, since such devices are familiar to the art; an example of which is the sideshifter consisting of two roll set supporting platforms which are moved to either side of the mill window during the roll changing operation as illustrated in U.S. Pat. No. 3,779,061 dated Dec. 18, 1973.

Returning now to complete the description of the car **10**, as more fully illustrated in FIGS. **2** and **3**, and more particularly in FIG. **3**, in order to be able to rapidly but accurately adjust the roll carrying member **20** of the car **10**, there is provided a screw **30** and nut **32**. The nut **32** is securely mounted against rotation in the member **20** and the screw **30** is driven in and through both the member **20** and nut **32** by a worm gear unit **34** connected to an electric motor **36**. As the screw **30** rotates, it presses against a wear plate **38**, located underneath the screw **30** and mounted on the top **40** of the member **21**. This pressing of the screw **30** against the wear plate **38** forces the member **20** to be raised a controllable distance corresponding to a desired center of an upper roll.

In order to assure that the member **20** will be held against any tendency to rotate in the horizontal plane but still free to move vertically the member **20** is provided with two opposed wings **41**, shown only in FIG. **2**, received in complimentary slots **43** formed in a U-shaped member **44** which is part of a frame **45**. As noted in FIG. **3**, the frame **45** has an extension **47** that carries the gear-drive **34** of the electric motor **36**, the

gear unit being actually supported by a platform **47.** FIG. **2** shows that the member **21** is connected to a parallel link system consisting of three links **48, 50,** and **51.** Links **48** and **50** run parallel to each other and connect member **21** to a counterweight **52** at the bottom, while the link **51** connects member **20** to the counterweight **52** at the top. Between links **48, 50** and **51** is another electric motor **53** which drives, by way of a worm gear (not shown), a screw jack **55,** which upon operation presses against a wear plate at the underside portion of the link **51** to raise in parallel fashion the member **21** relative to the rolls. (This wear plate is not shown in the FIGS. **1, 2,** and **3.**) At this point, it will be appreciated that since all three links are pivotally connected at one end to the frame **45** of the member **21** by insertion of pins **57** and **59,** and, in turn, they are pivotally connected at the other end to the counterweight **52** by insertion of pins **61** and **63,** that as these links are displaced angularly by the operation of the screw jack **55,** the member **21** as well as the member **20** maintains a horizontal position during vertical movement.

To the right of the members **20** and **21,** as one views FIGS. **1, 2,** and **3,** but best illustrated in FIG. **2,** and still with reference to the construction of the car **10,** rests the counterweight **52** located in the plane between the two back wheels **16.** The total weight of a pair of work rolls of the type illustrated in these FIGS. **1, 2,** and **3** may be in a typical four high, hot or cold, rolling mill of the order of 40,000 lbs. During the lowering and/or raising of the rolls **26** and members **20** and **21,** their total weight is partially off-set by the weight of the counterweight which is 5 to 10% greater than the set of roll assemblies. The electric motors **19, 36,** and **53** are controlled from a control box **65** located to the right of the counterweight and supported by the car, as viewed in FIG. **1.**

In operation, and in referring to removing the worn rolls from the mill, the car **10** is brought to a position adjacent the mill window, by a rack and pinion arrangement **18.** In this position, the need, if any, for exact adjustment for alignment with the centers of the worn rolls can be determined and made. After this, the ends of the rolls **26** are received in the openings **22** and **23** of the members **20** and **21,** respectively, by further operation of the rack and pinion arrangement **18,** and depending on the nature of the four high roll arrangement, the top work roll may be moved vertically to permit raising of the lower work roll off of its back-up roll, or both rolls may be moved together in each case by operating the motor **53.** In many cases, it may not be necessary to lower the upper work roll free of the upper back-up roll since a spaced relationship may have been previously assumed in preparation for the work roll changing.

Once cantileverly supported by the car **10,** the rolls **26** can be retracted to a position where they can be lowered by the car onto one of the two platforms **28** in a side-shifter device. If the bearing chocks are not nested or interfitted, stools will be inserted between the rolls, before the car releases the rolls in order to keep the top roll assembly from falling. It should be noted that the vertical dimensions of the stools are such that the rolls are maintained on fixed centers for both the minimum and maximum roll sizes. After this, the car **10** is further retracted to disengage the rolls and allows the platform carrying the old work rolls to move out from in front of the mill and the platform carrying the new stooled work rolls to move in front of the mill and in front of the car **10.** This will place the new set of work rolls is position to be engaged and raised off the platform by the members **21** and **20** of the car **10.** Even if the work rolls differ in the location of their axes to the work rolls just removed from the mill, there is no need to adjust the members **20** and **21** since, as noted, this is taken care of by the fixed center stools.

Once the rolls are raised off of the platform by operating the motor **53,** the stools can be removed and the platform moved to the side of the mill opposite to the side that the platform carrying the worn work rolls was moved and the car **10** carrying the new work roll set in a cantilever fashion is advanced to a position adjacent the mill window.

While in this raised position, the new rolls can again be adjusted either simultaneously while maintaining an equal distance between themselves and/or the member **20** can be independently adjusted so that the new rolls will be properly aligned with respect to the driving couplings of the mill for automatic insertion of the rolls into the couplings. After this takes place, the lower roll **26** can be lowered to its proper operating position on top of the lower back-up roll by again operating the motor **53.**

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof.

I claim:

1. An apparatus for removing and replacing rolls to and from a rolling mill or the like comprising:

a car arranged on the operator's side of the said mill, said car including a counterweight mounted on one end arranged to offset at least a part of the weight of one or more of said rolls when supported by said car,

two members carried by the other end of said car having portions for receiving and supporting in a cantilever fashion a different one of said rolls in a position parallel to their working positions when said rolls are in said mill,

means for displacing one of said members parallel and relative to other member in a direction coincident to a plane containing the axes of said rolls,

means for displacing said two members in unison in said direction, and

means for horizontally moving said car to and from said rolling mill.

2. An apparatus according to claim **1,** wherein said two members are so constructed and arranged that said one member moves within said other member in a guided manner relative to the other member in said direction.

3. An apparatus according to claim **2,** including means for supporting said members comprising a system of parallel links so constructed and arranged so as to cause a raising and lowering of said members in a manner that an equidistance is maintained between said members.

4. An apparatus according to claim **3,** wherein means for displacing said two members in unison includes a screw jack means,

said screw jack means mounted to engage one of the links of said parallel link system.

5. An apparatus according to claim **1,** wherein said means for moving said car includes a rack and pinion arrangement.

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