United States Patent

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[54] ROLL CHANGING APPARATUS

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

[51] **Int. Cl.** **B21b 31/08**

[58] **Field of Search** 72/237, 238, 239, 225, 241

[56] **References Cited**

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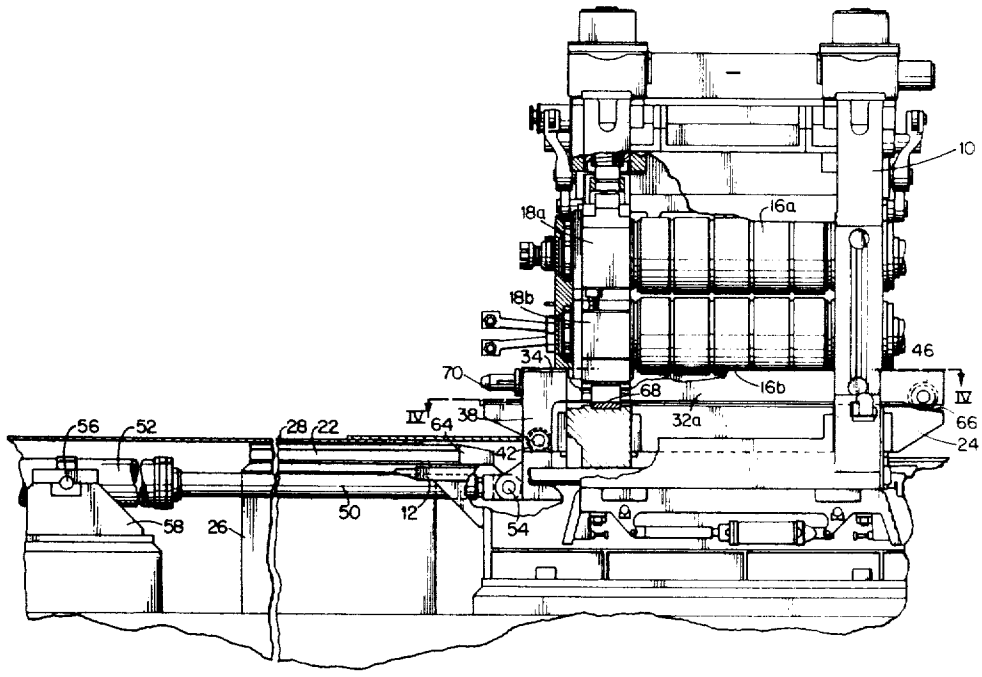
[57] **ABSTRACT**

An apparatus for changing work rolls in a rolling mill. The apparatus includes a carriage assembly mounted on tracks for movement into and out of a roll housing through a housing window. The carriage assembly is adapted to receive and carry a roll package made up of a plurality of work rolls rotatably supported between bearing chocks. The tracks are so arranged that upon movement of the carriage assembly and roll package carried thereon into the housing, the carriage assembly is gradually lowered to transfer the roll package onto the housing, with the result that the roll package is solely supported by the housing when operatively contained therein.

11 Claims, 8 Drawing Figures



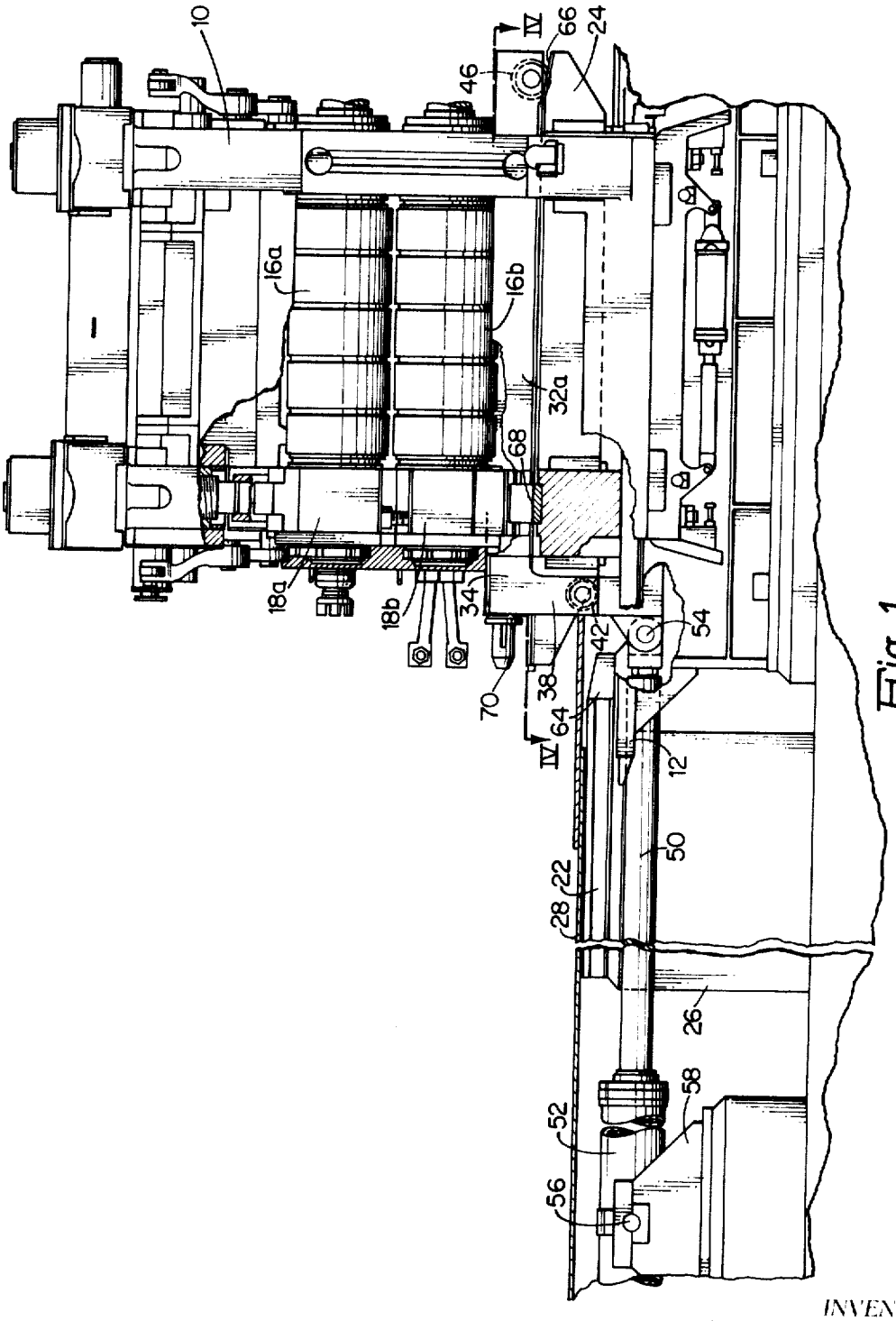


Fig. 1.

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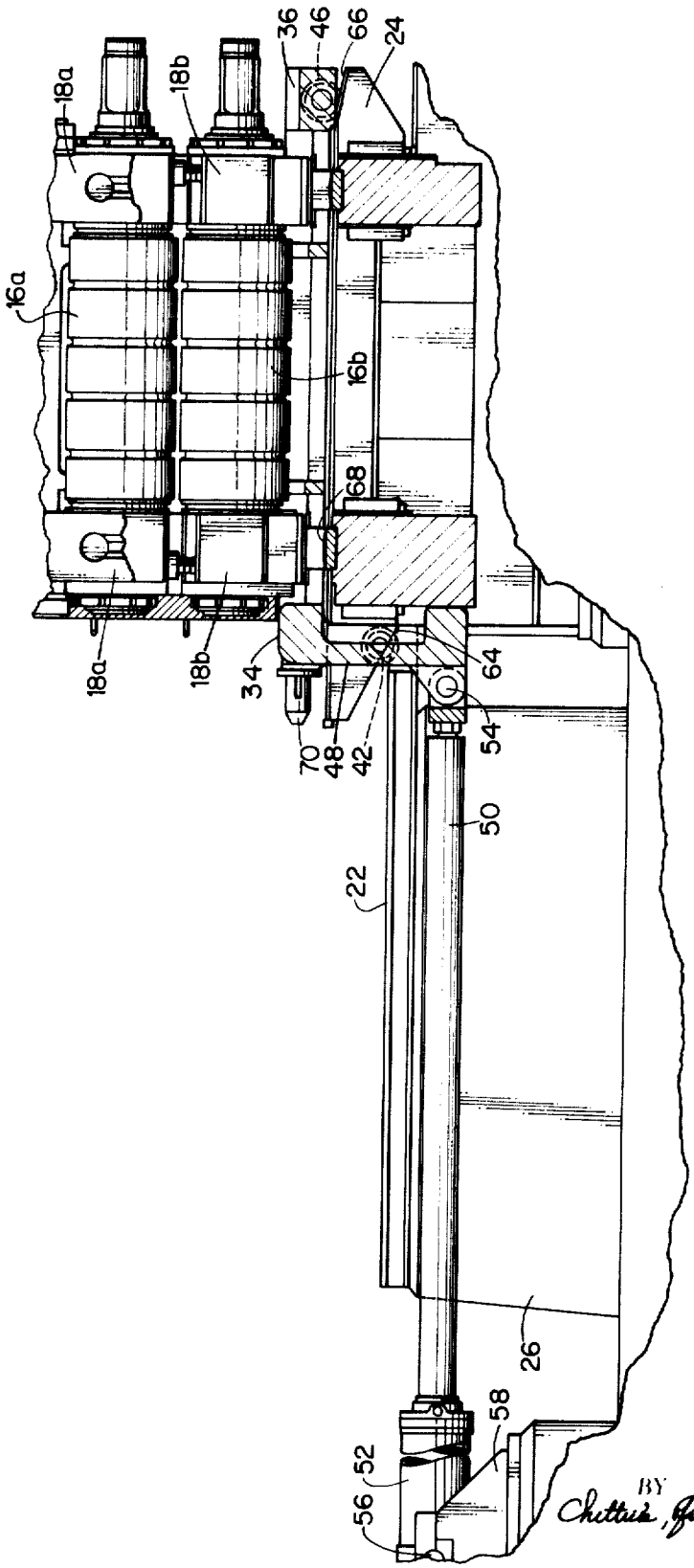

Fig. 2.

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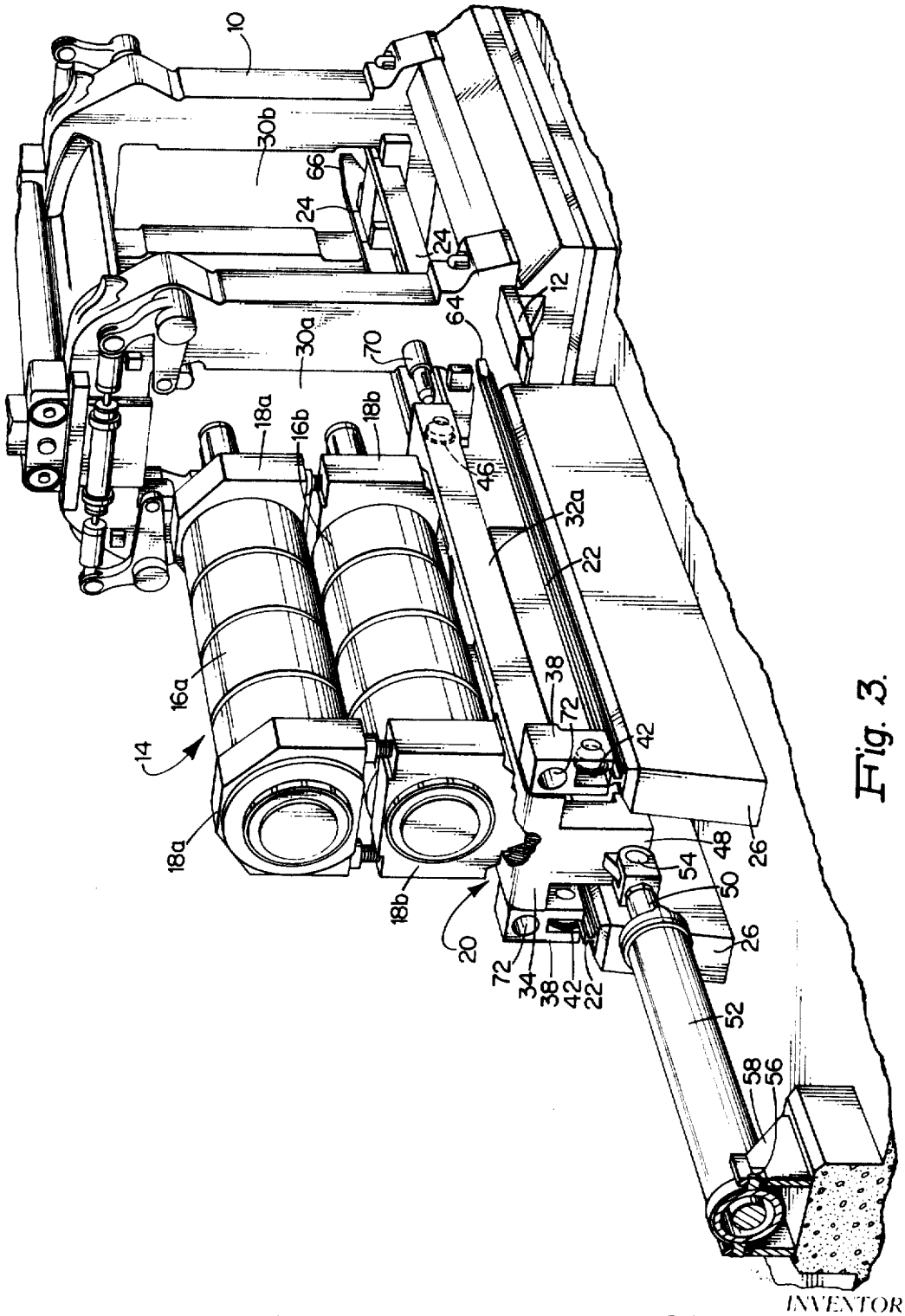

Fig. 3.

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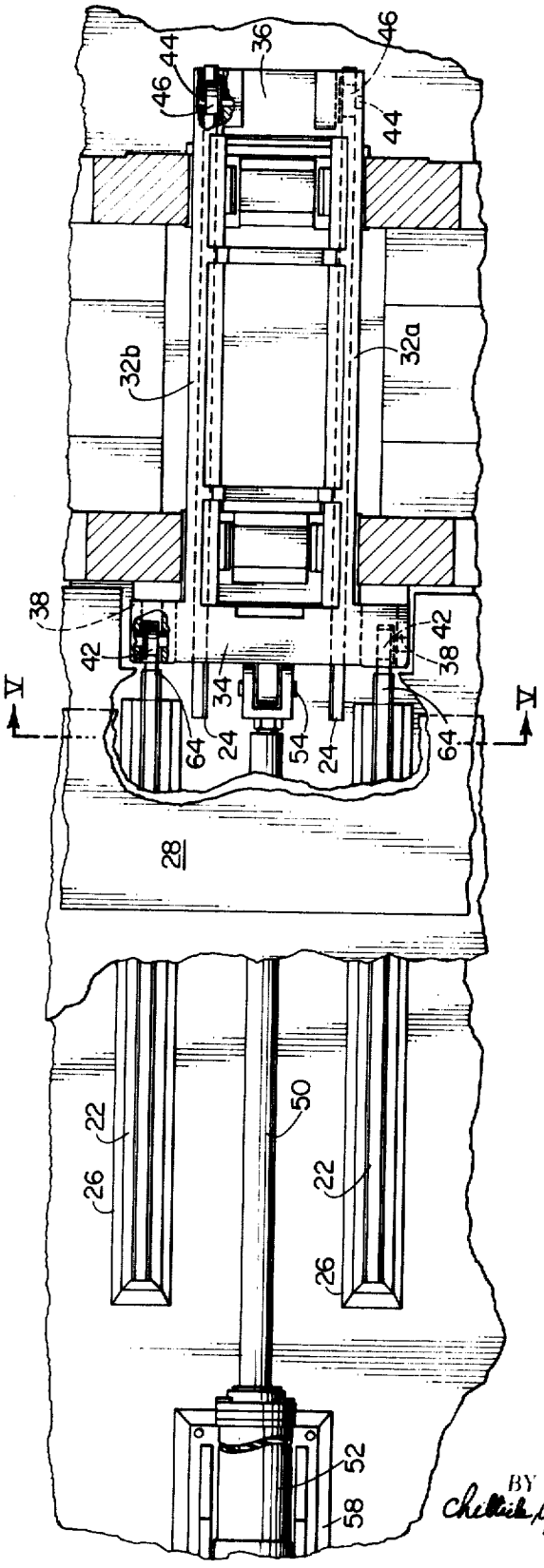

Fig. 4.

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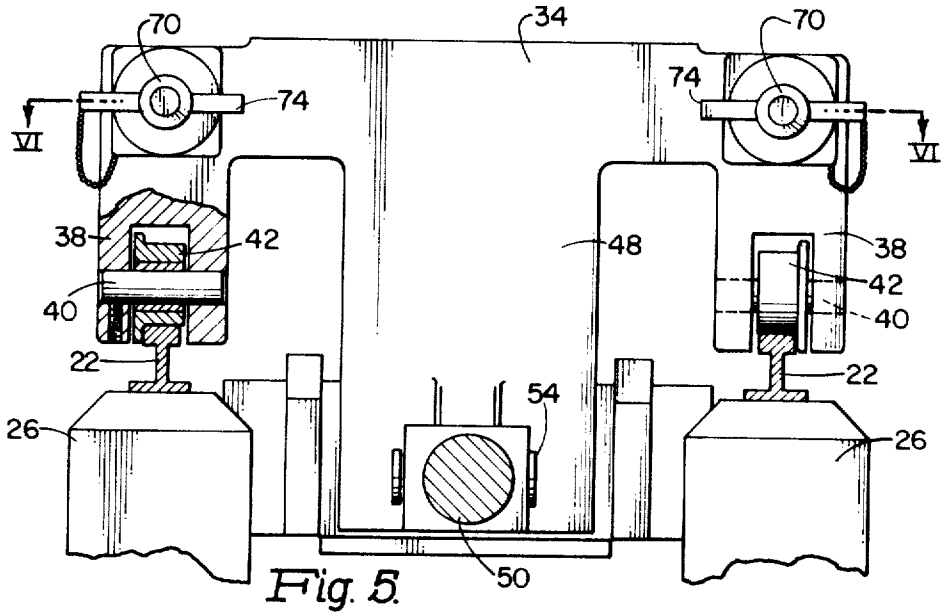

Fig. 5.

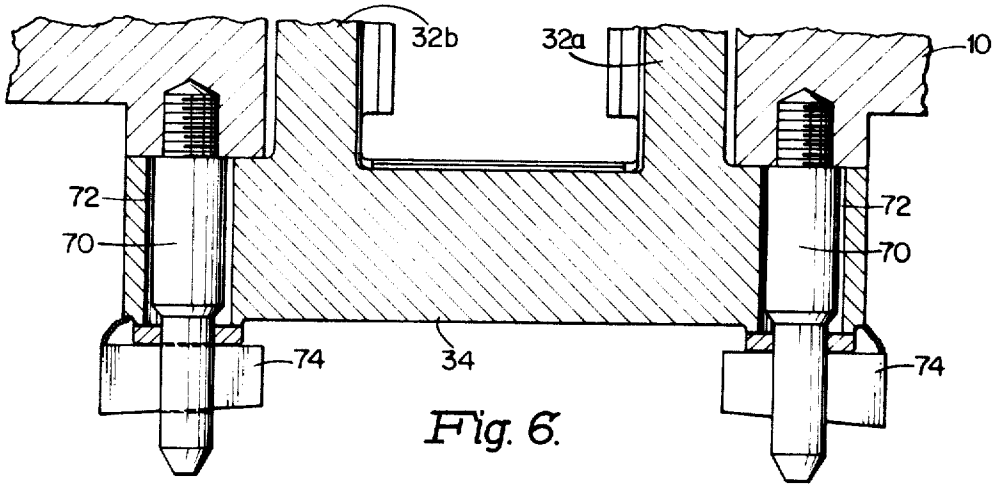

Fig. 6.

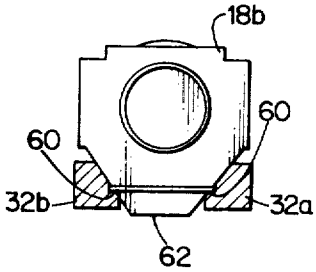

Fig. 7.

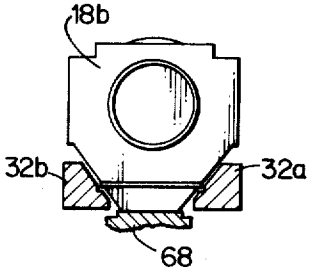

Fig. 8.

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ROLL CHANGING APPARATUS

DESCRIPTION OF THE INVENTION

This invention relates generally to rolling mills and more particularly to an improved apparatus for changing work rolls.

Known roll changing devices, particularly those embodying carriages or "sleds" for carrying a roll package into and out of a roll housing, have in general been unsatisfactory because of their tendency to adversely effect the structural stiffness and rigidity of the roll housings. One reason for this undesirable result lies in the fact that the vertical dimensions of the housing windows have in the past been increased substantially beyond that required to accept the roll packages in order to accommodate the underlying carriages or sleds. An increase in the height of the housing window necessitates a proportional increase in the height of the housing structure, thereby also increasing the tendency of the housing to stretch when subsequently subjected to the roll separating forces experienced during operation of the mill.

It should also be noted that in the past, the practice has been to allow the roll changing carriages or sleds to remain positioned between the housing and the lowermost roll chocks of the roll package during the rolling operation. This increases the number of interfaces between the housing and roll package, with a corresponding further decrease in structural stiffness and rigidity.

Accordingly, it is a general object of the present invention to provide an improved roll changing apparatus embodying a novel carriage assembly and supporting track arrangement which avoids the problems and disadvantages mentioned above.

A further and more particular object of the present invention is to support the roll package on a carriage assembly which is movable through a housing window along a system of tracks between an inoperative position exterior of the housing an operative position at which the roll package is contained within and supported solely by the housing, with the design and arrangement of the carriage being such as to require substantially no vertical enlargement of the housing window beyond that required to accept the roll package.

Another object of the present invention is to reduce the number of interfaces between the housing and the roll package contained therein. This is accomplished by arranging the track system in a manner such that upon entering the housing, the carriage is lowered until the roll package is deposited directly on the housing.

Another object of the present invention is to provide a novel and improved means for laterally displacing both the carriage assembly and the housing relative to the mill pass line.

These and other objects and advantages of the present invention will become more apparent as the description proceeds with the aid of the accompanying drawings wherein;

FIG. 1 is a front elevation with parts broken away of a roll housing and roll changing apparatus embodying the concepts of the present invention;

FIG. 2 is a partial vertical section on an enlarged scale through the roll housing and roll changing apparatus shown in FIG. 1;

FIG. 3 is a perspective view of the apparatus shown in FIG. 1 with the roll package and carriage assembly in the inoperative position exterior of the roll housing;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 1 with the roll package removed for the purpose of better illustrating the carriage and underlying track system;

FIG. 5 is an end view of the carriage assembly taken along line 5—5 of FIG. 4.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is a sectional view through the carriage assembly showing the lower roll chocks of the roll package supported thereon; and,

FIG. 8 is a view similar to FIG. 7 after the carriage assembly has been moved to the operative position, with the lower roll chocks supported directly on the housing.

Referring initially to FIGS. 1 and 2, there is shown a roll housing 10 mounted on underlying rails 12 for movement in a direction transverse to the mill pass line. The roll housing is adapted to contain a roll package generally indicated at 14 (See FIG. 3), the latter including a pair of work rolls 16a and 16b each respectively journalled for rotation between roll chocks 18*a* at 18*b*. The roll package i4 is shown in its operative position contained within the housing in FIGS. 1 and 2, and in its inoperative position withdrawn from the housing in FIG. 3.

The roll changing apparatus of the present invention is comprised basically of a carriage assembly 20 (FIG. 3) which in the embodiment herein disclosed, is movably mounted on a track system made up of first and second track members 22 and 24. The first track members 22 are supported exterior of the housing on raised fixed abutments 26. The top surfaces of the first track members are preferably located at approximately mill floor level, shown in FIGS. 1 and 4 by a removable floor plate 28.

The second track members 24 are attached to and supported by the roll housing 10. The ends of the second track members 24 preferably extend through the using windows 30*a* and 30*b* located at either side of the housing.

In the embodiment herein disclosed, the carriage assembly 20 is comprised of two spaced parallel side members 32*a* and 32*b* joined at one end by a transverse front member 34 and at the other end by a transverse rear member 36.

As is best shown in FIG. 5, the front transverse member 34 is provided with a pair of integral depending legs 38 which support axles 40 on which are rotatably mounted front wheel members 42. The front wheel members are arranged to run along the first track members 22.

With reference to FIG. 4, it will be seen that the rear member 36 likewise supports axles 44 on which are rotatably mounted rear wheel members 46 suitably spaced and arranged to run along the second track members 24.

Referring now to FIGS. 2, 3 and 5, it will be seen that the front transverse member 34 of carriage assembly 20 is further provided with an additional leg member 48 depending centrally between the leg member 38 supporting the front wheel members 42. The piston rod 50 of a double acting cylinder 52 (preferably hydraulically actuated) is pivotally connected as at 54 to the leg member 48. The cylinder is in turn pivotally connected as at 56 to a stationary support member 58.

Retraction of piston rod 50 causes the carriage assembly 20 to be laterally withdrawn from the housing along first and second track members 22 and 24 to the position shown in FIG. 3. When thus withdrawn from the housing, the carriage assembly is suitably positioned to receive and carry the roll package 14. When the roll package is placed on the carriage, the chocks 18*b* of the lowermost roll 16*b* are supported as at 60 (see FIG. 7) on the side members 32*a* and 32 *b* of the carriage assembly. When thus positioned, the bearing surfaces 62 of the lowermost chocks 18*b* are located below the carriage side members 32*a* and 32*b*. Thus it will be seen that because the carriage side members 32*a* and 32*b* in effect "straddle" the lower roll chocks 18*b*, the combined height of the carriage assembly and roll package is approximately equal to that of the roll package alone.

Movement of the roll package 14 from the inoperative position shown in FIG. 3 to the operative position shown in FIG. 1 is accomplished by simply extending piston rod 50. This causes the carriage assembly 20 with the roll package 14 supported thereon to be moved along the track system comprised of first and second track members 22 and 24 through housing window 30*a* in a direction transverse to the mill pass line. As the piston rod 50 approaches the end of its stroke, the front wheel members 42 descend downwardly sloping end portions 64 on the first track members 22. At the same time, the rear wheel members 46 descend identically sloped portions 66 on the ends of the second track members 24. The combined effect is to lower the carriage assembly 20 relative to the housing structure 10, thereby causing (See FIG. 8) the bearing sur-

faces 62 on the lowermost roll chocks 18b to come into contact with underlying bearing surfaces 68 on the housing 10. Accordingly, it will be seen that when the carriage assembly 20 reaches the position shown in FIG. 1, the roll package is supported directly on the roll housing.

With particular reference to FIGS. 5 and 6, it will be seen that the roll housing 10 is additionally provided with a pair of laterally extending connecting pins 70. The pins are suitably spaced and arranged to extend through apertures 72 in the front transverse member 34 of carriage assembly 20 when the latter is in the position shown in FIG. 1. Locking wedges 74 are then inserted transversally through slots in the pins 70 to securely fasten carriage assembly 20 to the housing 10. Thereafter, further extension and or retraction of piston rod 50 results in a corresponding combined movement of both the carriage assembly 20 and housing 10 along tracks 12 in a direction transverse to the mill pass line.

Having thus described a preferred embodiment of the invention, the advantages offered by this construction will now be better understood by those skilled in the art. More particularly, it will be seen that when the carriage assembly 20 is in the inoperative position shown in FIG. 3, a roll package 14 may be easily mounted thereon. Once this has been accomplished, the piston rod 50 of cylinder 52 is extended to push the carriage through housing window 30*a* into the the housing. Because the carriage straddles the lower roll chocks 18*b*, substantially no increase in the required height of the window 30*a* is required and accordingly the overall modulus of elasticity of the housing is not adversely affected.

As the roll package approaches its operative position within the housing, the carriage assembly 20 is gradually lowered as the front and rear wheels 42 and 46 roll over the inclined end portions 64 and 66 of the first and second track members 22 and 24. This causes the lower bearing surface 62 on the chocks 18*b* to come into direct contact with the underlying bearing surfaces 68 of the housing. As previously mentioned, this offers the further advantage of reducing the number of interfaces between the roll package and the housing to an absolute minimum of one with a further corresponding increase in housing rigidity over that offered by the prior art constructions.

With the roll package operatively positioned with the housing, the locking wedges 74 are next employed to lock the carriage assembly 20 to the laterally extending pins 70 on the housing. Once this has been accomplished, the piston rod 50 of cylinder 52 is extended further to laterally displace the housing 10 relative to the pass line along rails 12. This particular arrangement is of course advantageous in that it allows one cylinder 52 to serve two functions, namely the lateral displacement of the carriage assembly 20 relative to the housing 10 and the lateral displacement of the entire housing relative to the mill pass line.

Alternatively, a spare roll package might be mounted on a spare carriage and the roll parting completely pre-set at a remote location while the rolling operation is in progress. When a roll change is required, the spare assembly would be carried to the housing and quickly substituted in the manner just described for the assembly being removed from the housing. Under these conditions, the carriage would serve the additional function of providing a fixture for carrying roll packages between the housing and the remote set-up location.

Having thus described a preferred embodiment of the invention, it will be understood that a number of modifications may be made without departing from the spirit and scope of the invention as defined by the claims appended hereto.

I claim:

1. Apparatus for moving a roll package between a first position exterior of a roll housing and a second position contained within the housing, said apparatus comprising: track means extending between said first and second positions; carriage means movable along said track means between said positions, said carriage means being adapted to receive and support the roll package at said first position, said track means including means cooperating with said carriage means during movement of the latter into said second position to transfer the roll package from said carriage means directly onto the housing.

2. The apparatus as claimed in claim 1 wherein said track means is comprised of first and second parallel track members, said first track members being located at one level at said first position, and said second track members being carried by said housing at said second position at a level above that of said first track members.

3. The apparatus as claimed in claim 2 further characterized by said means cooperating with said carriage means comprising inclined surfaces which cause the said carriage means to be displaced vertically relative to said housing when said carriage means is moved between said first and second positions.

4. The apparatus as claimed in claim 3 wherein said housing includes bearing means between said second track members, the vertical displacement of said carriage means being such that the roll package is lowered onto said bearing means when said carriage means is moved along said track means from said first position to said second position.

5. The apparatus as set forth in claim 2 further characterized by operating means for moving said carriage means along said track means between said first and second positions.

6. The apparatus as claimed in claim 5 further characterized by said housing being movably mounted on third track members, said third track members being parallel to said first and second track members.

7. The apparatus as set forth in claim 6 further characterized by means for securing said carriage means to said housing when said carriage means is at said second position, whereby subsequent movement of said carriage means relative to and beyond the ends of said first track members will result in corresponding movement of said housing along said third track members.

8. In a rolling mill, for use with a roll housing of the type having an opening in the wall thereof through which a roll package is moved between an operative position contained within the housing and an inoperative position exterior of the housing, apparatus for moving a roll package between said operative and inoperative positions comprising in combination: first and second longitudinal track members, said first track members being separate from said housing at one level underlying said inoperative position, said second track members being mounted on said housing at a level above that of said first track members; carriage means mounted on said track members for movement between said operative and inoperative positions, said carriage means forming a bed adapted to receive and carry the roll package; said carriage means being further provided with wheel members arranged at two levels to roll along said first and second track members respectively; operating means connected to said carriage means for moving said carriage means between said operative and inoperative positions, said first and second track members being further provided with inclined end sections which when contacted by said wheel members, result in the carriage means being displaced vertically relative to the housing, the vertical displacement of said carriage means being such that the roll package is lowered onto the housing when said carriage means is moved along said track members from said inoperative position to said operative position.

9. The apparatus as claimed in claim 8 further characterized by said housing being movable in a direction parallel to the length of said first and second track members.

10. The apparatus as claimed in claim 9 further characterized by means for connecting said housing to said carriage means when said carriage means is at said operative position, whereupon further movement of said carriage means by said operating means will result in a corresponding movement being imparted to said housing.

11. Apparatus for moving a roll package through an opening in a roll housing between a first position exterior of the roll housing and a second operative position contained within the

housing, said apparatus comprising: carriage means for carrying the roll package at said first position, said carriage means being mounted on track means for movement through said opening between said first and second positions, said track means providing that at said second position the elevation of said carriage means relative to the housing is lowered so that the weight of the roll package is transferred from said carriage means onto the housing.

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