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LIFTING DEVICE FOR REMOVING AND REPLACING ROLL ASSEMBLIES IN A ROLLING MILL

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Fig. 1.

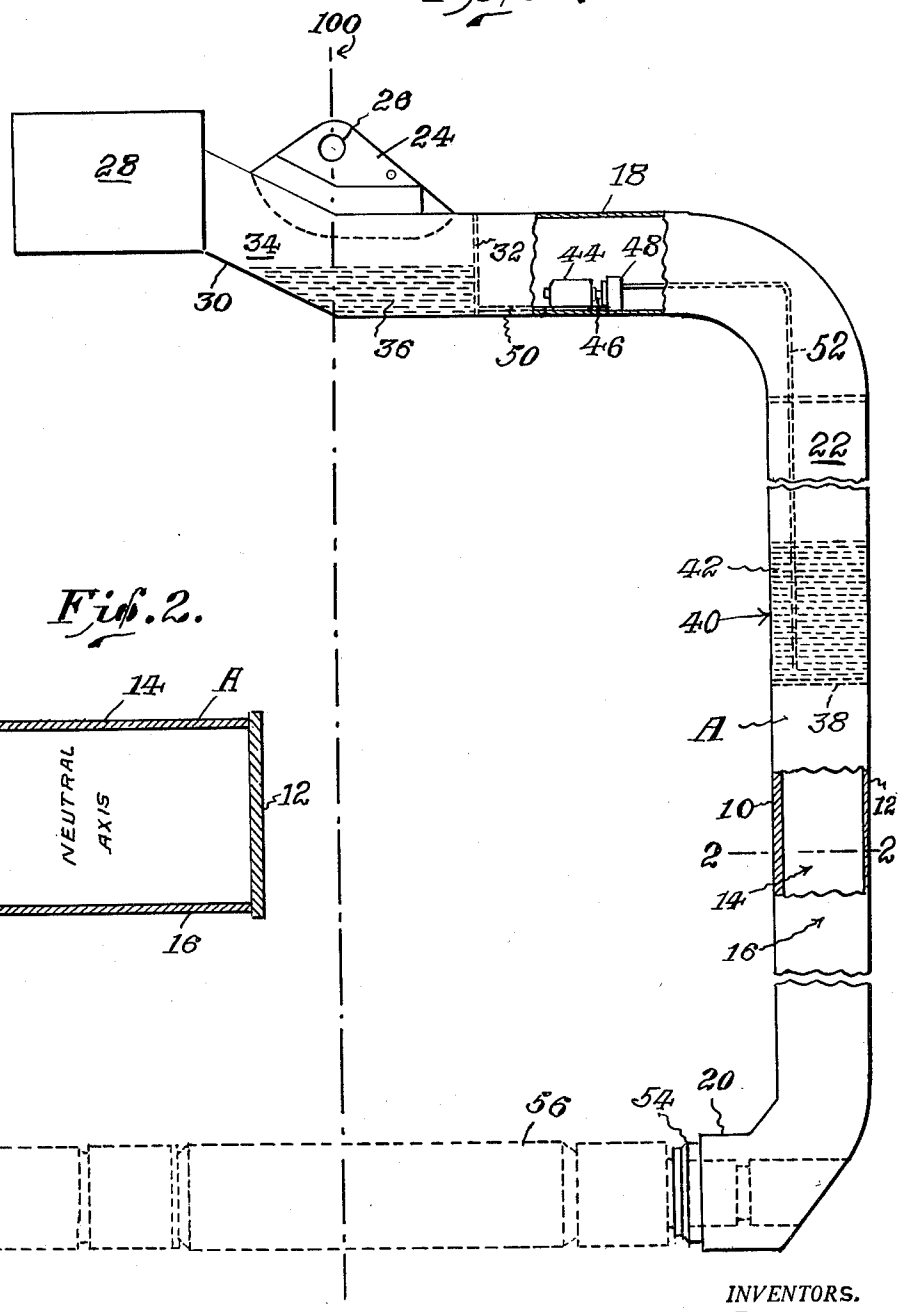


Fig. 2.

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LIFTING DEVICE FOR REMOVING AND REPLACING ROLL ASSEMBLIES IN A ROLLING MILL

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This invention is concerned with means for readily removing and replacing the rolls of a rolling mill, which rolls are used in heating and pressing operations in the steel industry.

Due to the fact that a new roll assembly amounts to about 88,000 lbs. and a worn roll which is removed to make room for the new roll weighs about 81,000 lbs., it is necessary to provide a device which will lift the worn roll from its position on the roll assembly of a rolling mill. It is necessary to lift the worn roll with its axis in the substantially horizontal position. After its removal, the new roll should be supported and lowered into place in the rolling mill with its axis of rotation in a substantially horizontal plane.

A principal object of the invention is to accomplish the above purposes, i.e. to remove and replace the worn roll with a new roll and maintain the axes of both rolls, during the two operations, in a substantially horizontal plane.

Inasmuch as heretofore considerable time has been lost in replacing a worn roll with a new roll in the operation of a rolling mill, another important feature of the invention is the provision of means for replacing the worn roll with a new roll with a minimum of time lost.

A further object of the invention is to provide a lifting device of the type noted above which employs hydraulic means for shifting the center of gravity to correct any unbalance in the two rolls, the said device being provided with weight means in the form of a fluid which may be quickly shifted from one side to the other of the lift point. Usually the unbalance is small due to the fact that the lift point is substantially on a vertical line over the center of gravity of an average roll assembly.

A further object of the invention is to shift the center of gravity of the lifting device on either side of the lift point thereof while the lifting device is loaded, i.e., while it is supporting a roll assembly.

Other objects will appear hereinafter throughout the specification.

In the drawings:

FIGURE 1 is a side elevational view, partly broken away and partly in vertical section; and

FIGURE 2 is a vertical section on the line 2—2 of FIGURE 1.

As may be surmised from the above description and objects, the device is in the nature of a C hook. Such C hooks are provided with upper and lower spaced horizontal arms joined to each other at their ends by a vertical arm, the upper horizontal arm being provided with a means whereby it may be suspended by the hook of a crane of sufficient capacity to lift the device and the mill roll with assembled bearing housings and coupling. The lower arm is of particular shape for slipping over the coupling shaft extension of a mill roll whereby to hold the same in a horizontal position while being lifted. In the present construction, the upper arm contains a loop or spool suitable for receiving the hook of a crane, the said means being located on said arm so that the point of lift of the crane is substantially on a vertical line over the center of gravity of the mill roll assembly being lifted.

Referring now to the drawings, the lifting device as a whole is indicated by the letter A. While the cross section of the lifting device may be of any suitable shape, it is preferably rectangular, as shown in FIGURE 2, wherein the shorter sides are indicated by the reference numerals 10 and 12 and the longer sides by numerals 14 and 16.

The upper arm is indicated by numeral 18 and the lower arm by numeral 20, these arms being connected to each other by the vertical arm 22. The upper arm is provided with a flange 24 having an eye or aperture forming a point of suspension 26, the same preferably extending through the center of gravity 100 (when the lifting device is loaded) for receiving the hook of a crane (not shown) or other lifting means.

As seen in FIGURE 1, mounted on the left end of the upper arm is a fixed counterweight 28 which roughly counterbalances the weight of the arms located to the right of the point of suspension 26.

As will be noted by reference to FIGURE 2, arms 18 and 22 are hollow. The upper arm is provided with inclined portion 30 on one side of the point of suspension and with transverse wall 32 on the opposite side of said point of suspension, whereby to provide a reservoir 34 for holding a suitable fluid 36. The vertical arm 22 is also provided with a transverse wall 38 which forms a second reservoir 40 for holding fluid indicated at 42.

Located between the two reservoirs is a motor means, such as a 3 H.P., about 1160 r.p.m., reversible electric motor 44. The motor shaft 46 is coupled to a self-priming reversible fluid pump indicated by reference numeral 48. This pump is connected by pipe means 50 to the reservoir 34, and it is also connected by pipe 52 to the reservoir 40. This construction is such that when the motor and pump are running in one direction, fluid, such as water or oil, may be transferred from reservoir 34 to reservoir 40, and when the pump and motor are reversed, fluid is removed from reservoir 40 and pumped into reservoir 34. In this manner, the amount of unbalance may be readily compensated for by shifting the fluid from one reservoir to another. The water may be added to from time to time by means of an opening (not shown) that will permit the raising or lowering of the fluid in either reservoir, the opening being located above either reservoir.

The lower arm 20 is provided with a coupling device or socket indicated by reference numeral 54 which is designed to slip over the conventional coupling shaft extension of a mill roll.

It will be distinctly understood that the weight 28 may be dispensed with, and in its place a compartment may be provided for holding additional fluid on the left side of the point of suspension.

The vertical arm of the lifting device is of sufficient length to permit the horizontal arm 18 to extend over the top of the mill housings when the mill roll is in its normal working position in the housings.

The horizontal or upper arm 18 of the device is provided with a point of lift or crane hook receiver 26 so located that the point of lift of the crane is substantially on a vertical line over the center of gravity of the mill roll assembly to be lifted during the removal operation thereof or during the lowering and replacing of a new mill roll assembly when the latter is being lowered in the proper position in the housings. In either case, the end 20 of the lifting device is caused to engage the coupling device on one end of the mill roll assembly.

The counterweight, which may be a solid weight as indicated at 28 or an additional container for liquid, is of sufficient weight to cause the entire lifting device to hang on the crane hook in a normal lifting position when no load is being lifted, with arms 18 and 20 in a horizontal position.

Due chiefly to the coupling device 54 on one end of the mill roll assembly, the center of gravity of a new

roll with assembled bearing housings and couplings may vary from that of a worn roll assembly by one inch or more. The present invention, therefore, includes the provision of a hydraulic means for quickly balancing a lifting device with a roll assembly thereon each time a roll assembly is lifted, whereby to maintain the roll in a substantially horizontal position, as it must be for easy removal or replacement in the mill housing.

In the present construction, the amount of unbalance is small due to the placement of the lift point substantially on a vertical line over the center of gravity of an average roll assembly. Accurate balancing is accomplished by pumping liquid from one compartment to another within the horizontal and vertical arms of the lifting device. In a typical case, a 100-gallon per minute motorized pump, such as indicated at **48**, will pump **60** gallons of liquid from one reservoir to the other of reservoirs **34** and **40**, the said reservoirs being located approximately 14 feet 8 inches from each other, whereby to compensate for a new roll assembly weighing 88,000 lbs. for replacement of a worn roll assembly weighing 81,000 lbs. and having a center of gravity 1 inch farther to the left of the lifting device socket **54** than the center of gravity of the new roll assembly when in the supported position of the lifting device. It is customary to use a level (not shown) of any suitable type on the suspended roll in order to determine whether the roll is being supported with its axis in a horizontal or substantially horizontal position.

Assuming the lifting device has been loaded either during the removal of a worn roll or the lowering into place in the rolling mill of a new roll, should there be any unbalance of the lifting device, the fluid in the reservoirs may be shifted from one reservoir to the other in less than one minute by the operation of the motor and pump in order to provide a true balance with the axis of the roll in a horizontal plane.

The above description and drawings disclose a single embodiment of the invention, and specific language has been employed in describing the several figures. It will, nevertheless, be understood that no limitations of the scope of the invention are thereby contemplated, and that various alterations and modifications may be made such as would occur to one skilled in the art to which the invention relates.

We claim:

1. A lifting device for removing and replacing roll assemblies in a rolling mill comprising an upper substantially horizontal arm and a lower substantially horizontal arm, a vertical arm connecting said horizontal arms adjacent the ends thereof, said lifting device having a point of suspension comprising means for receiving a crane hook or other hoist, at least two reservoirs on said lifting device, one of said reservoirs being located on the upper horizontal arm with at least a portion of one of said reservoirs being located on one side of a vertical line passing through said point of suspension and a second reservoir on the opposite side of a said vertical line, said lower arm having means for supporting a roll assembly,

and means for transferring fluid from one reservoir to another reservoir whereby to maintain the axis of said lower arm in substantially horizontal position during the lifting and lowering operations of said lifting device and when supporting a roll assembly thereon.

2. The structure of claim 1 in which said transferring means includes a motor means, a reversible pump driven thereby, and conduit means connecting each reservoir to said pump whereby fluid may be withdrawn from one reservoir and transferred to the other reservoir or vice versa.

3. The structure of claim 1 wherein said upper horizontal arm is provided with a solid weight located thereon.

4. The structure of claim 1 wherein said means for supporting said roll assembly comprises a socket adapted to slip over and engage the coupling shaft extension of a mill roll.

5. The structure of claim 1 wherein one of said reservoirs is located within said upper horizontal arm and the other reservoir is located within said vertical arm.

6. The structure of claim 1 wherein said upper horizontal arm and said vertical arm are provided with sides forming a rectangle in cross section, and transverse wall means in each of said arms forming a reservoir therein.

7. The structure of claim 6 wherein said transfer means includes a motor, a pump connected thereto, and conduit means connecting said pump to each reservoir.

8. The structure of claim 7 wherein said motor and pump are located between said reservoirs and within said upper horizontal arm.

9. A lifting device for removing and replacing roll assemblies in a rolling mill comprising an upper substantially horizontal arm and a lower substantially horizontal arm, a vertical arm connecting said horizontal arms adjacent the ends thereof, said lifting device having a point of suspension comprising means for receiving a crane hook or other hoist, at least two reservoirs on said lifting device, one of said reservoirs being located on the upper horizontal arm on both sides of a vertical line passing through said point of suspension, and a second reservoir being located on the vertical arm on one side of the said vertical line passing through said point of suspension, said lower arm having means for supporting a roll assembly, and means for transferring fluid from one reservoir to the other whereby to maintain the axis of said lower arm in substantially horizontal position during the lifting and lowering operations of said lifting device and when supporting said roll assembly.

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