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 APPARATUS FOR ROTATABLY INCHING THE GEARS
 OF A ROLLING-MILL FINION STAND
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FIG. 1.

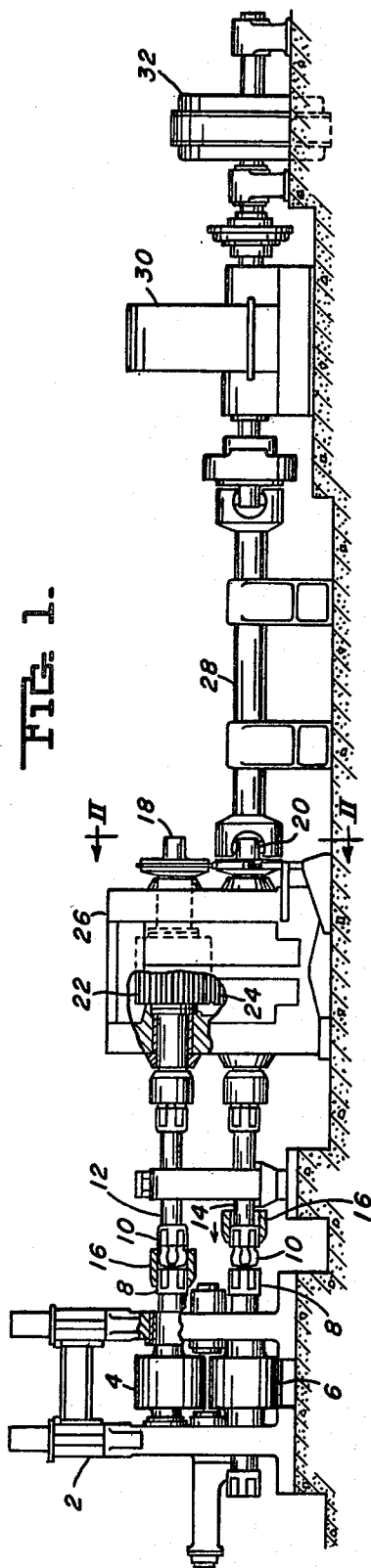
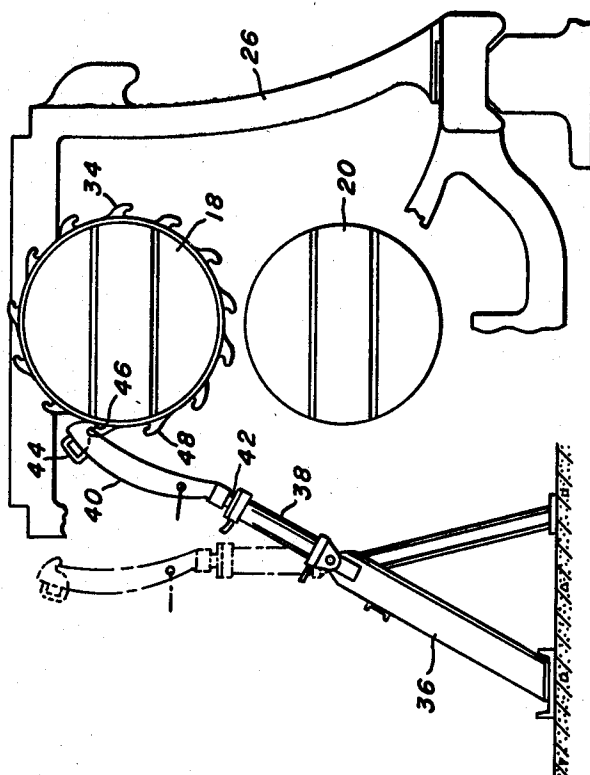


FIG. 2.



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APPARATUS FOR ROTATABLY INCHING THE GEARS OF A ROLLING-MILL PINION STAND

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2 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus includes a ratchet wheel circumferentially mounted on a rolling-mill pinion gear shaft for rotation therewith. An upright bracket is disposed adjacent the gear shaft and supports a fluid pressure cylinder which is pivotally mounted by its head end on the upper end of the bracket for pivotal movement toward and away from the ratchet wheel. A ratchet arm, which is rigidly connected with and extends longitudinally from the projecting end of the piston of the cylinder, is adapted to engage the teeth of the ratchet wheel when the cylinder is pivoted toward the wheel. The cylinder is actuated to move the ratchet arm circumferentially of the wheel and cause rotational inching of the pinion gear shaft.

The present invention relates generally to rolling-mill equipment and more particularly to apparatus for rotatably inching a pinion gear shaft of a rolling-mill drive train to properly align a driving spindle, which is attached to the gear shaft, with a work roll of the mill so that a coupling connection between the spindle and the work roll can be effected.

In the processing of rolled structural metal sections, the sections are rolled through a plurality of roll passes in a rolling-mill line to achieve a desired finished size and shape. A plurality of roll-stands arranged in tandem and each housing an upper and lower work roll make up the rolling mill line. Frequent roll replacements or changes are required for producing the various size and shape structural sections rolled, the contour of each roll conforming to the desired structural section. In each of such roll changes, the upper and lower work rolls in a mill stand are disconnected from the drive train which powers the work rolls and the entire stand is removed from the mill line and is replaced by another complete rolling-mill stand which has been assembled at a location remote from the mill line with work rolls of the desired configuration and size.

The drive train servicing each mill stand usually includes a pinion stand housing intermeshed upper and lower pinion gears, a gear-type speed reducer, and an electric motor. The pinion stand is disposed adjacent the roll stand and the gears thereof are connected with the necks of the work rolls in the roll stand by means of upper and lower drive spindles. The drive spindles are each connected by one end with the shaft of the respective gear in the pinion stand and at its other end with the roll neck of the corresponding upper or lower work roll in the roll stand. The connection between the drive spindles and the work rolls is effected by means of wobblers on the adjoining ends of the spindles and the work roll necks and sleeve box couplings which fit around and interconnect each pair of wobblers.

One of the pinion gear shafts in the pinion stand, usually the lower one, is coupled to a lead spindle which, in turn, is connected with and driven by the output shaft of the speed reducer. The speed reducer is driven by the power shaft of the electric motor.

After the newly assembled mill stand has been posi-

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tioned, it is necessary to align the top and bottom drive spindles with the necks of the work rolls in the roll stand. After the spindles and roll necks are in a position where the wobblers on the adjoining ends thereof are properly aligned, the respective pairs of wobblers are connected together by means of the sleeve box coupling. To position each spindle relative to its respective adjoining roll neck so that the spindle wobbler and roll neck wobbler will be properly aligned, it is necessary to rotate the entire mill train a fraction of a turn (usually less than 90°). Proper alignment of the wobblers is necessary to permit the sleeve box couplings to be advanced thereover to lock them together.

Prior to our invention, this rotation of the mill train was accomplished by looping a steel cable around a projecting extension of the upper pinion gear shaft and then attaching the cable to the hook of an overhead crane. Then, as the hook was lifted, the cable would tighten, rotating the complete gear train until the wobbler on one of the drive spindles was properly aligned with the wobbler on its respective adjoining roll neck so as to permit a coupling sleeve to be advanced thereover for completing the interconnection. This process was repeated again to align and interconnect the second roll neck and spindle. There were many disadvantages inherent in the practice of this procedure, e.g., it creates a hazardous condition for workmen in the area; it was excessively time consuming and difficult to control; and it required the use of an overhead crane to the detriment of concurrent crane requirements in the mill area.

It is, accordingly, the primary object of our invention to provide an apparatus for rotatably inching a rolling-mill gear shaft which will cause rotary inching of the spindles attached to the gear shafts in a precisely controlled manner.

It is another object of our invention to provide apparatus as set forth by the above statement of object which does not require the use of an overhead crane.

It is a more specialized object of our invention to provide apparatus as set forth by the preceding statements of object which includes a ratchet wheel circumferentially mounted on the pinion gear shaft extension of a rolling-mill pinion stand, and a ratchet arm mounted for movement toward and from the ratchet wheel adapted to engage the teeth of the ratchet wheel when moved into position toward it; and power means connected with the ratchet arm to move it circumferentially of the gear shaft when engaged with a tooth of the ratchet wheel to thereby accomplish rotary inching of the gear shaft.

The above and other objects will become more apparent after referring to the following specification and attached drawing in which:

FIGURE 1 is a front elevational view of a rolling-mill stand assembly and its drive train having the apparatus of the invention incorporated therein; and

FIGURE 2 is an enlarged cross-sectional view taken along the line II—II of FIGURE 1.

Referring more particularly to the drawing, reference numeral 2 designates a rolling-mill stand containing upper and lower work rolls 4 and 6, respectively. The ends of the roll necks projecting from the drive side of the mill stand 2 are each formed with wobblers 8 which are aligned and connected with wobblers 10 on the ends of upper and lower drive spindles 12 and 14, respectively. The wobblers on the work-roll necks and the wobblers on the adjoining ends of the drive spindles are linked together by means of sleeve box couplings 16. The ends of the drive spindles 12 and 14 remote from the mill stand 2 are connected to the projecting shafts 18 and 20, respectively, of meshed upper and lower pinion gears 22 and 24, respectively, housed in a pinion stand 26 adjacent the mill stand 2. An extension of each of the shafts 18 and 20

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projects outwardly of the pinion stand on the side thereof remote from the mill stand 2. The projecting extension of the lower pinion gear shaft 20 is connected with and driven by a lead spindle 28. The lead spindle 28 is connected with and driven by a speed reducer 30, which, in turn, is connected with and driven by the power shaft of an electric motor 32.

The apparatus thus far described is conventional and is not claimed as our invention, the details of which will now be set forth.

A ratchet wheel 34 is fixedly mounted circumferentially about the projecting extension of upper pinion gear shaft 18, and an upright supporting bracket 36 is rigidly mounted on and projects upwardly from the mill floor below and to one side of the extension of shaft 18, as best shown in FIGURE 2. A double-acting fluid pressure cylinder 38 is pivotally mounted by its head end on the upper end of the bracket 36 for pivotal movement toward and away from the upper pinion gear shaft extension 18. A ratchet arm 40 is rigidly connected with and extends longitudinally from the projecting end of the piston rod 42 of the cylinder 38. The distal end of the ratchet arm 40 may be provided with a handle 44 to facilitate manual movement of the cylinder and ratchet arm assembly toward and from the ratchet wheel 34. The distal end of the ratchet arm is hook shaped, as at 46, so as to enable it to positively engage the teeth 48 of the ratchet wheel 34 when the cylinder and arm are pivoted toward the shaft extension 18, as will become apparent. The cylinder is connected to suitable sources of pressure fluid and exhaust means (not shown).

In operation, when a replacement mill stand is placed in a mill line and it is desired to align the necks of the work rolls 4 and 6 with the drive spindles 12 and 14, respectively, so that the wobblers 8 and 10 are properly aligned to receive the sleeve box couplings 16, the power source for motor 32 is cut off. The switch controlling the power source is locked in inoperative open position to prevent inadvertent operation of the power train while the roll stand is being installed. Cylinder 38 is then actuated to project piston rod 42; the handle 44 of the ratchet arm 40 is grasped; and the cylinder and ratchet arm assembly is pivoted toward the ratchet wheel 34 to cause the hook end 46 of the ratchet arm 40 to engage one of the teeth 48 of the ratchet wheel. Cylinder 38 is then actuated to retract the piston rod 42. This causes the ratchet arm to move downward and rotate the ratchet wheel 34 and the shaft extension 18 in counter-clockwise direction, as viewed in FIGURE 2. If further rotary inching of the shaft 18 is necessary to align the wobbler 10 on spindle 12 with the wobbler 8 on the roll-neck 4, the cylinder 38 is again actuated to project the piston rod 42 so that the ratchet arm moves upwardly and engages the next suc-

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ceeding tooth of the ratchet wheel. The cylinder 38 is then actuated to again retract piston rod 42. This causes additional inching of the shaft extension 18 in counter-clockwise direction. After the wobblers on the roll-neck 4 and spindle 12 have been properly aligned, the sleeve box coupling 16 is advanced to enclose the aligned wobblers. Then the procedure is repeated to align and connect the wobblers on the neck of lower work roll 6 and lower drive spindle 14. After the two spindles and roll-necks have been properly aligned, the cylinder and ratchet arm assembly is pivoted to resting position as shown by broken lines in FIGURE 2.

While we have shown by one embodiment of our invention, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. In a rolling mill including a pinion stand, intermeshed pinion gears in said stand, each of said pinion gears including a center shaft projecting outwardly of said stand, the improvement therewith of apparatus for rotatably inching each of said pinion gears, said apparatus comprising a ratchet wheel circumferentially mounted on one of said pinion gear shafts for rotation therewith, a ratchet arm pivotally mounted adjacent said ratchet wheel for movement between one position toward and in engagement with said ratchet wheel and another position away from and out of engagement with said ratchet wheel, and power means connected with said ratchet arm for moving the same circumferentially of said ratchet wheel when in said one position to thereby rotatably inch said ratchet wheel and said one pinion shaft and gear.

2. Apparatus as defined by claim 1 including a support bracket adjacent said ratchet wheel, said power means comprising a fluid pressure cylinder having a piston rod projecting therefrom pivotally mounted on said supporting bracket for movement toward and away from said wheel, said ratchet arm being rigidly connected with and extending substantially longitudinally from the piston rod of said cylinder.

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