H. R. GEER.

ROLLING MILL SPINDLE COUPLING.

APPLICATION FILED NOV. 19, 1910.

1,041,773.

Patented Oct. 22, 1912.

Fig. 1.

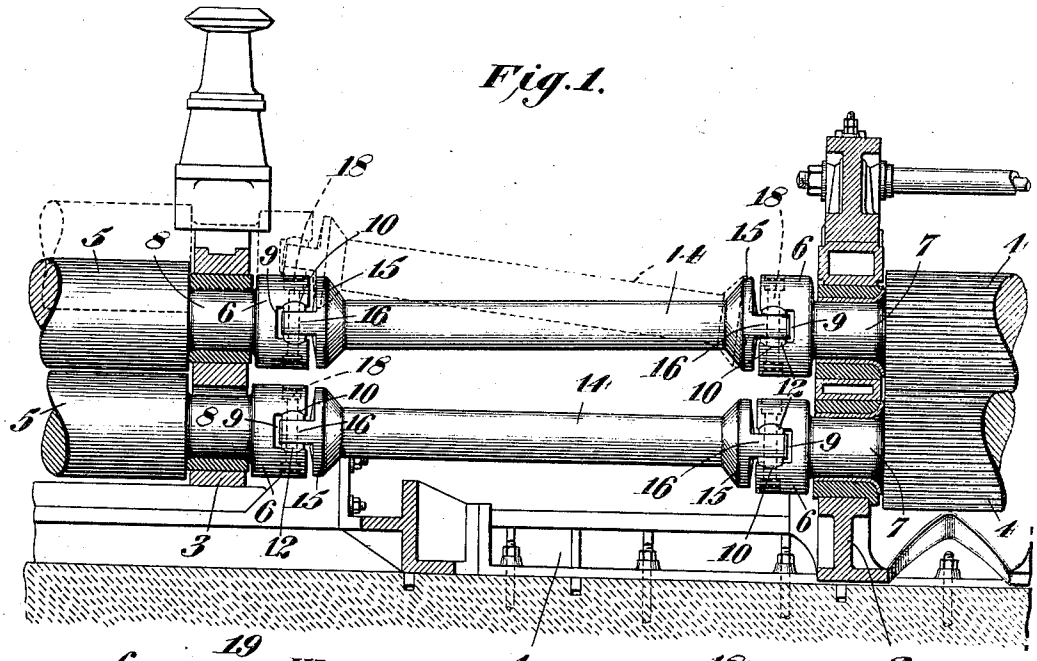


Fig. 2.

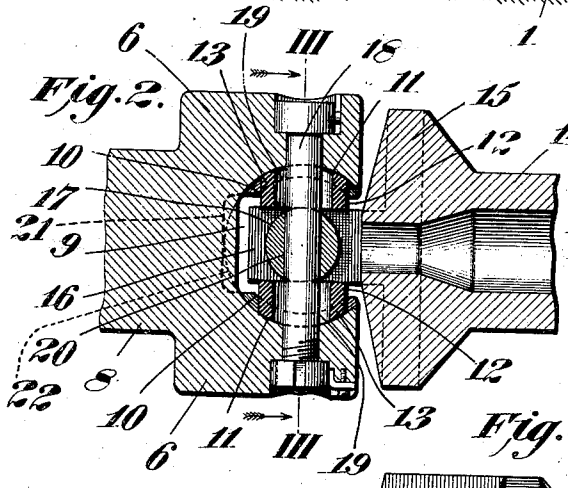


Fig. 3.

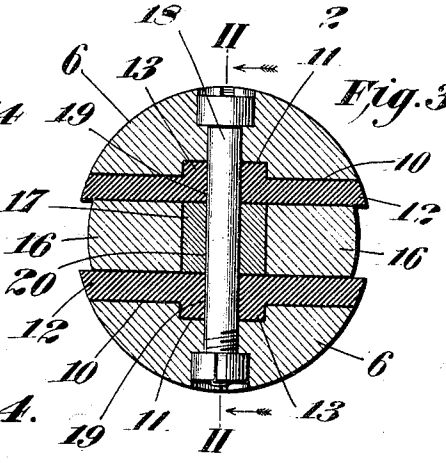


Fig. 4.

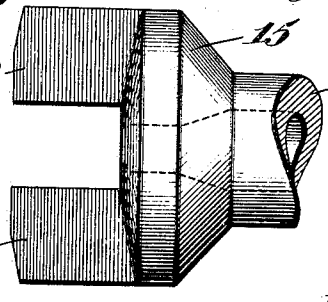


Fig. 5.

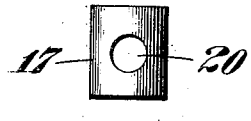
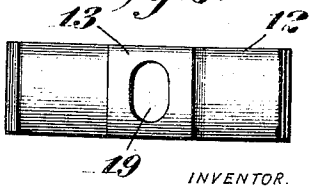


Fig. 6.



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## ROLLING-MILL SPINDLE-COUPLING.

1,041,773. Specification of Letters Patent. Patented Oct. 22, 1912.

Application filed November 19, 1910. Serial No. 593,149.

*To all whom it may concern:*

Be it known that I, HARRY R. GEER, a citizen of the United States, residing in the city of Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Rolling-Mill Spindle-Couplings; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to rolling-mill apparatus and particularly to the spindle-couplings thereof which connect the driving shafts or customary pinions to the roll-necks, for the purpose of rotating the rolls.

My invention is particularly adapted for use in connection with metal-rolling mills of the two-high, or three-high type, the rolls of which require frequent adjustment in a vertical direction to accommodate the different sizes of bars, blooms, plates or other products being operated upon, while maintaining at the same time operative rotative connection with the pinions or source of power.

Heretofore it has been generally customary to drive a pair or a set of three pinions by driving one of the same through the connection of one of its necks with the continuously or reversely rotating shaft of a steam engine, or other motor, while the other ends or so-called necks of the pinions are provided with similar connections for driving the rolls as hereinafter described.

The ordinary old styles of pinion-necks and roll-necks are substantially cylindrical in form, and the outer portions of the same which project from the bearings or housings are provided with three or four flutes, each flute being a rectangular, trapezoidal, semi-circular or semi-oval longitudinal groove. The old style coupling-box as at present used, is composed, generally speaking, of a cylindrical annulus provided on its interior surface with projections corresponding to the flutes in the necks of the pinions and rolls.

The ordinary old style spindle consists generally of a cylindrical shaft provided at each end with flutes similar to those provided in the pinion-necks and roll-necks, and the pinions and rolls are thereby rotatively connected by the use of said coupling-boxes and spindles. Owing to the rude construction of these pinion-necks, roll-necks, spindles and coupling-boxes, and the necessary large amount of clearance in same to allow for irregularities and adjustments of the pinions and rolls, this construction is very noisy in operation, and on account of the backlash in use, is very destructive to the parts directly involved and to the other portions of the mechanism connected therewith, by reason of the jarring and hammering action occasioned by said loose connection. This is particularly true on what are known as two-high reversing mills where the backlash of a set of old style spindles and couplings frequently amounts to one-third or one-half of a complete revolution of a rolling-mill engine or motor. In other words, when reversing an engine or motor for the purpose of operating a mill, this frequently has to turn around through about one hundred and eighty degreees before the rolls begin to move and the momentum thus acquired by, and the inertia of the heavy rolls, engines, spindles, coupling-boxes, fly-wheels, and other parts, causes very severe and destructive percussion on the spindles and couplings and also jars the other parts of the apparatus with frequent disastrous results. This effect is repeated at very short intervals of time as in two-high mills the reversal of their rotation is made after each pass. As an example of this, it has been found by experience on some mills that an old-style set of spindles and coupling-boxes will only last a week, as, by the end of that time, the fluted ends of the spindles and the corresponding projections in the coupling-boxes are so worn as to be useless, thereby necessitating their rejection and replacement by new ones, which is therefore, a constant source of labor and expense, besides which, such spindles and coupling-boxes frequently break in use, due in some cases to the wedging action of the worn parts.

My improved spindle-couplings are so constructed and arranged as to avoid the difficulties mentioned, as they are not subject to breakage or excessive wear, and I have demonstrated by actual experience, after a set of these has run for more than a month, that the only adjustment necessary

is the lining up or replacement of one or both of the slippers, which is cheaply and quickly done.

It is one of the principal objects of my invention to provide a spindle-coupling which will be practically noiseless in operation, without backlash or excessive clearance and my device is particularly applicable to reversing rolling-mills and those in which the rolls have to be moved upward or downward frequently during the process of their operation, as customary and necessary in plate mills, blooming mills, slabbing mills and the like.

My invention consists essentially of a spindle of general cylindrical form, provided at each end with projections which are substantially rectangular in cross-section, secured to, or integral with, the spindle, the major axis of said projections being transverse to the main axis of the spindle in general.

In my invention the pinion-necks and roll-necks each have bifurcated ends, the interior opposite surfaces of which form portions of a concave cylindrical surface, the axis of which is transverse to the main axis of the rolls and pinions. Within these curves are fitted so-called slippers or bearing pieces of bronze or other material, having convex curvatures where they bear and rock on the interior surfaces of the bifurcated ends of the roll or pinion-necks, while the other sides of said slippers have flat surfaces which are adapted to permit the opposite sides of the rectangular projections of the spindle to bear and slide thereon, thereby forming supports and bearings for the same. A large bolt passes through the roll or pinion-necks and the center of said slippers, which latter are provided with corresponding holes elongated transversely of said slippers to admit said bolt and permit the slippers to rock as herein described. The convex cylindrical surfaces of said slippers are adapted to bear against the concave cylindrical surfaces of the bifurcated ends of the roll and pinion-necks and to rock or partially rotate to and fro thereon in order to accommodate the vibrating or oscillating movement of the spindle as compared with the roll or pinion-necks, and this movement is greater as the angularity of the axis of the said spindle increases as compared with the position of the axes of the rolls and pinions.

Between the two projecting ends of my improved spindle is a central spacing-block preferably of cylindrical form, having a hole therethrough at right angles to the axis thereof, the said hole being adapted to receive and fit the bolt which passes through the bifurcated ends of the roll or pinion-necks as previously mentioned. This cylindrical spacing-block has flat, parallel ends which bear against the opposite interior surfaces of the two projecting ends of the spindle, thereby forming a support in one direction for said spindle, while the slippers and bifurcated ends of the roll or pinion-necks form supports in the other direction, thus holding same in position, while giving flexibility of joint in any direction. This construction can be made to fit quite accurately, thereby reducing all lost motion and backlash, while at the same time the details are such that my improved spindle can drive a roll even though the angular position of said spindle may be varied by the movement of the roll.

My construction is cheaply made and permits easy access for lubrication, inspection and replacement of parts, if necessary. The sliding movement of the projecting ends of the spindle between the slippers also allows for the greater length of spindle required, owing to the angularity of same when the roll is lifted, as will be readily understood.

Having thus given this general description of my invention, I will now, in order to make the matter more clear, refer to the accompanying sheet of drawings in which like numbers and characters indicate like parts:—

Figure 1 is a side elevation of a pair of pinions, a pair of two-high adjustable rolls, the driving connection between which consists of my improved spindle-coupling; the upper one of said spindles being what is generally known as the vibrating spindle, the amplitude of its movement being as indicated by the dotted lines in this figure. Fig. 2 is a vertical longitudinal sectional elevation of the connecting ends of my improved spindle-coupling taken on the line II—II of Fig. 3. Fig. 3 is a cross-sectional elevation taken on the line III—III of Fig. 2. Fig. 4 is a side view of one of the ends of my improved spindle. Fig. 5 is an illustration of the central spacing-block 17. Fig. 6 is a view of one of the slippers showing the convex cylindrical faces thereof and the elongated hole therethrough.

Referring now to the various characters of reference on the drawings:—1 represents parts of the bed-plates of a rolling-mill; 2 is one of the pinion housings therefor; 3 is one of the roll housings; 4 are the pinions, shown in this case for a two-high mill. The rolls of the two-high mill are indicated as 5 the upper one of which is shown by full lines in its lowered position, while the dotted lines indicate its higher position.

The bifurcated ends of my improved coupling which are secured to, or form part of the pinion and roll-necks, are indicated as 6, while 7 indicate the journal portions of the pinion-necks and 8 indicate the journal portions of the roll-necks.

The grooves in the couplings forming the bifurcations thereof, are indicated as 9, while the opposite interior surfaces of said bifurcations are indicated as 10 and 11 which are portions of a concave cylindrical surface adapted to receive and fit the corresponding convex surfaces of the slippers. The slippers 12 have a central projection or rib 13 having the general form of part of a solid cylinder adapted to fit in the corresponding concave surface 11 in the bifurcations of the coupling, while the main portions of said slippers rest and bear against the concave cylindrical surfaces 10. The spindles are indicated as 14 and are preferably hollow as shown to provide lightness and strength, the upper one being what is known as the vibrating spindle, shown in its lowered position by full lines, and in its upper position by the dotted lines.

The spindles 14 have enlarged ends 15 as shown, which are beveled as indicated, in order to allow for the vibration or angular movement of said spindles.

The projections at the ends of the spindle are indicated as 16, of substantially rectangular cross-section, arranged transversely to the principal axis of said spindle, the ends of said projections being beveled in order to make the structure compact and still provide the necessary clearance for vibration within the bifurcated ends of the coupling. The central spacing-block is indicated as 17 of substantially cylindrical form, having a hole 20 therethrough at right angles to the axis of said cylinder. The bolt 18 passes through the bifurcated ends of the coupling and is secured therein as shown and also passes through the elongated holes 19 in the slippers 12, while the spacing-block fits neatly on the central part of said bolt, as clearly shown in Fig. 2. The flat ends of said spacing-block bear against the interior opposite surfaces of the projections 16 and are adapted to slide thereon, while at the same time supporting said spindle by said projections in connection with the bolt 18.

The slippers 12 are each provided with an elongated hole 19 through which the bolt 18 passes, the form of said elongated hole being such as to permit the slippers to rock backward and forward without interference from said bolt, this rocking providing for the oscillating movement of the spindle in one direction. The oscillating movement of the spindle in the other direction is permitted by the sliding of the projections 16 on the flat surfaces of the slippers 12 and the spindle is supported meanwhile by the central block 17 which is rotatably fitted on the bolt 18 and slidably fitted between the opposite surfaces of the projecting ends 16 of the spindle.

In order that the concave cylindrical bearing surfaces within the bifurcated coupling 6 can be easily formed and machined on a boring mill, lathe, or other continuously rotating cutter, I may provide clearance for same by extending the transverse slot forming said bifurcation as indicated by the dotted lines 21 and 22 in Fig. 2, or otherwise as desired.

My improved spindle-coupling has approximately tight or working fits where one part adjoins the other, in so far as the transmission of rotative force in either direction is concerned, and it is also adapted to maintain this connection, notwithstanding its angularity of position, thereby forming a jointed connection of particular and powerful construction and well adapted for the use intended.

While my invention is shown and illustrated in connection with a two-high rolling-mill, it is equally applicable to a three-high, or other style of rolling-mill, and in fact to any apparatus or machine in which it is desired to transmit rotating motion, where, from lack of rigidity, necessity for automatic adjustment, or otherwise, an absolutely stiff coupling should not be used.

I do not limit my invention to the precise details of construction herein shown and described, as it is capable of considerable structural variation, and I may use such substitutions, modifications, equivalents or alterations therein, as fall within the scope of my invention and set forth in the claims.

What I claim as new and desire to secure by Letters Patent is:—

1. A spindle provided with a pair of integral projections of substantially rectangular cross-section, arranged transversely and forming an opening at the end thereof, a bifurcated coupling adapted to receive said projections, said bifurcated coupling having its opposite interior surfaces of concave cylindrical form arranged transversely thereof; slippers fitting the flat surfaces of said projections adapted to allow the same to slide thereon, the opposite sides of said slippers being of convex cylindrical curvature fitting within the corresponding concave surfaces of the bifurcated ends of the coupling, a cylindrical spacing-block, the flat ends of which are slidably mounted between said projections and a bolt passing transversely through said block said slippers and the bifurcated coupling.

2. A spindle provided with a pair of integral projections of substantially rectangular cross-section arranged transversely at the end thereof, a bifurcated coupling having a corresponding transverse groove, the opposite interior surfaces of which are of concave cylindrical form, slippers fitting the flat surfaces of said projections adapted to allow the same to slide thereon, the opposite sides of said slippers being of convex cylindrical curvature in rocking contact

with the corresponding concave surfaces aforesaid, a cylindrical spacing-block, the flat ends of which are slidably mounted between said projections and a bolt passing transversely through said block said slippers and the bifurcated coupling.

3. A spindle provided with a pair of integral projections of substantially rectangular cross-section arranged transversely at the end thereof, a corresponding bifurcated coupling adapted to receive said projections, said bifurcated coupling having its opposite interior surfaces of concave cylindrical form arranged transversely thereof, slippers fitting the flat surfaces of said projections and adapted to allow the same to slide thereon, the opposite surfaces of said slippers being of convex cylindrical curvature in rocking contact with the corresponding concave surfaces of the bifurcated ends of the coupling, a cylindrical spacing-block, the flat ends of which are slidably mounted between said projections and a bolt passing transversely through said block said slippers and the bifurcated coupling.

4. A spindle provided with a pair of integral projections of substantially rectangular cross-section spaced apart and arranged transversely at the end thereof, a bifurcated coupling having a corresponding transverse groove, the interior opposite surfaces of which are of concave cylindrical form, slippers fitting the flat surfaces of said projections adapted to allow the same to slide thereon, the opposite sides of said slippers being of convex cylindrical curvature fitted within the corresponding concave surfaces of the bifurcated ends of the coupling and adapted to rock therein, a cylindrical spacing-block, the flat ends of which are slidably mounted between said projections and a bolt passing transversely through said block said slippers and the bifurcated coupling.

5. A spindle provided with a pair of projections of substantially rectangular cross-section spaced apart and arranged transversely at the end thereof, a bifurcated coupling having a corresponding transverse groove, the opposite interior surfaces of which are of concave cylindrical form adapted to receive said projections, slippers fitting the flat surfaces of said projections and adapted to allow the same to slide thereon, the opposite sides of said slippers being of convex cylindrical curvature in rocking contact with the corresponding concave surfaces of the bifurcated ends of the coupling, a cylindrical spacing-block located between the interior ends of said projections, the flat ends of which are adapted for sliding contact therewith, and a bolt secured through said bifurcated ends and passing through elongated holes in said slippers and through said spacing-block, whereby the aforesaid parts are held in operative position.

6. A spindle provided with a pivot arranged transversely at the end thereof, said pivot being composed of a pair of integral projections of substantially rectangular cross section, with slippers slidably mounted on the opposite flat sides thereof, the other said sides of said slippers being of convex cylindrical curvature, a corresponding bifurcated coupling having oppositely-disposed concave cylindrical surfaces adapted to receive said projecting pivot and allow the same to rock therein, a cylindrical spacing-block, the flat ends of which are slidably mounted between said projections and a bolt passing transversely through said block said slippers and the bifurcated coupling.

7. A spindle provided with a pair of integral projections of substantially rectangular cross-section spaced apart, and arranged transversely thereof, a bifurcated coupling having a corresponding transverse groove, the opposite interior surfaces of which are of concave cylindrical form, slippers slidably mounted on the flat surfaces of said projections, the opposite sides of said slippers being of convex cylindrical curvature in rocking contact with the corresponding concave surfaces of the bifurcated coupling, a cylindrical spacing-block, the flat ends of which are slidably mounted between said projections and a bolt passing transversely through said block said slippers and the bifurcated coupling.

8. A spindle provided with a pair of integral projections spaced apart and arranged transversely at the end thereof, a bifurcated coupling having a corresponding transverse groove, the opposite interior surfaces of which are of partially cylindrical concave form, slippers slidably mounted on the opposite flat sides of said projections, the other sides of said slippers being of convex cylindrical curvature in rocking contact with the corresponding grooves of the bifurcated coupling aforesaid, a cylindrical spacing-block located with its flat ends slidably bearing between the ends of said projections, and a bolt passing through said bifurcated coupling, through elongated holes in said slippers, and through a corresponding hole in said spacing-block, thereby holding the parts in operative position.

9. A spindle provided with a pair of integral projections of substantially rectangular cross section arranged transversely at the end thereof and provided with a slot or space between the same, a corresponding bifurcated coupling having a transverse groove adapted to receive said projections, the opposite interior surfaces of said groove being of cylindrical concave curvature ar-

ranged transversely of the axis of said coupling, bearings located within said bifurcations adapted for rocking contact with the curved surfaces thereof, and for sliding contact with the opposite surfaces of the projections of said spindle, a cylindrical spacing-block located within the intermediate slot aforesaid, the flat ends of same bearing against the opposite surfaces thereof, and a bolt passing through said bifurcated coupling, through elongated holes in said bearings and through a corresponding hole in said spacing-block.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

HARRY R. GEER.

Witnesses:
ELMER SEAVEY,
ROBERT A. BEERS.