Dec. 21, 1954 E. T. PETERSON 2,697,335

ROLLING MILL SPINDLE AND COUPLING

Filed June 11, 1951 4 Sheets-Sheet 1

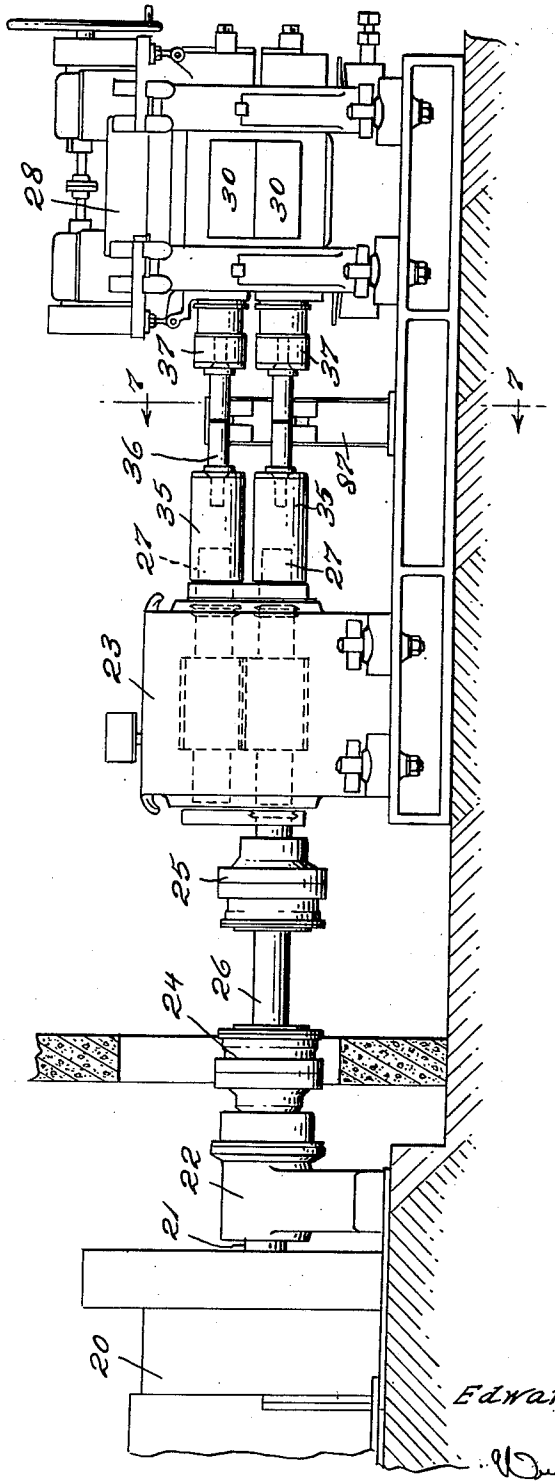


Fig. 1.

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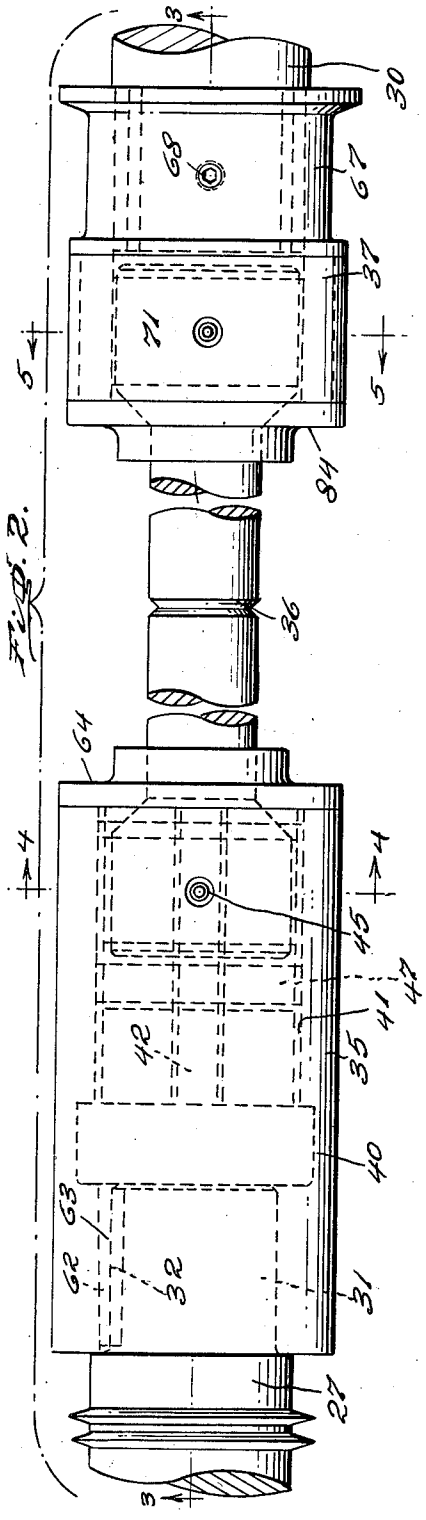


Fig. 2.

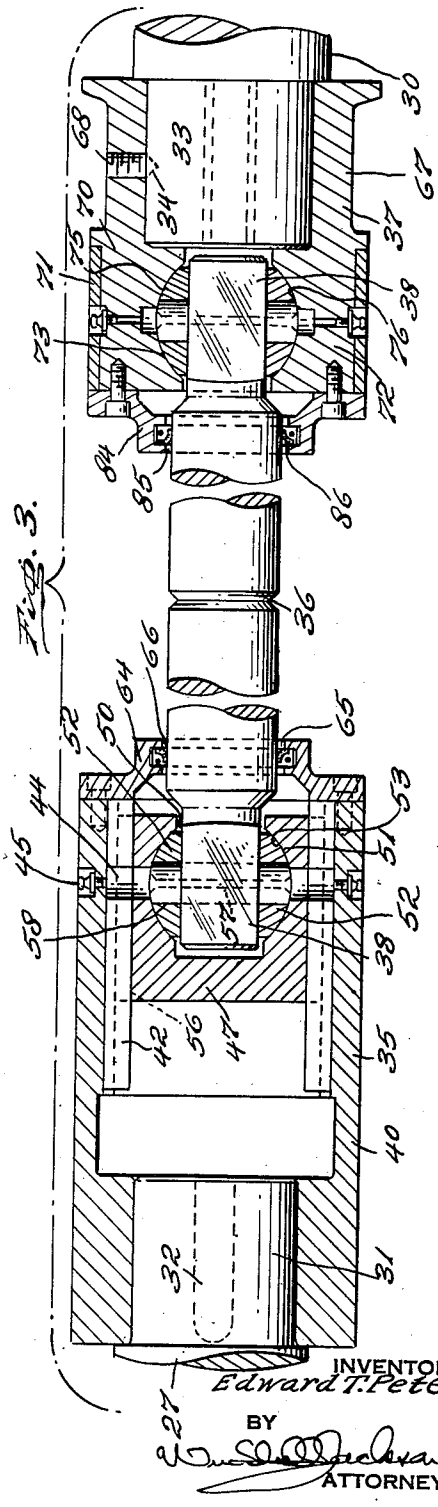


Fig. 3.

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Fig. 4.

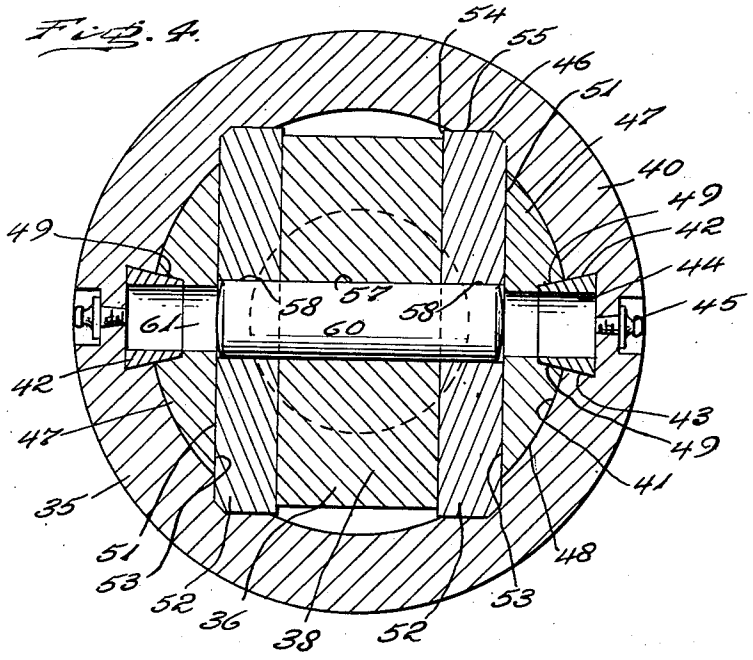
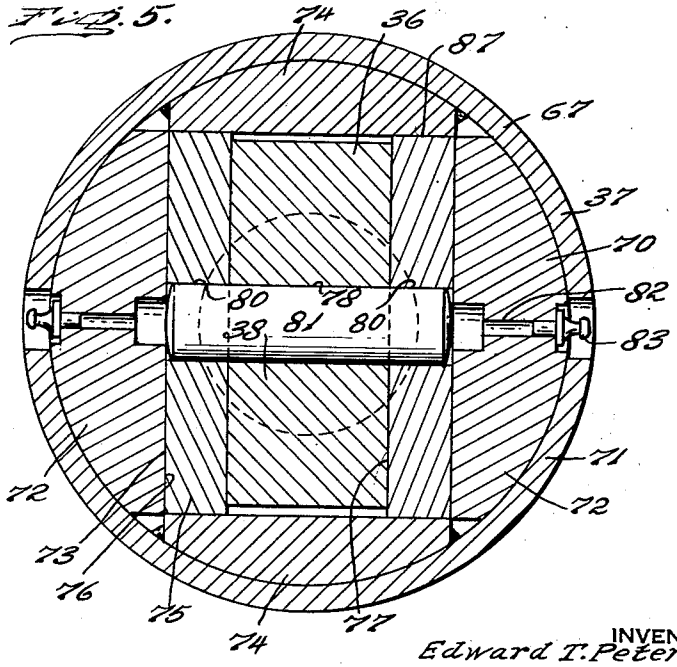


Fig. 5.



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Fig. 7.

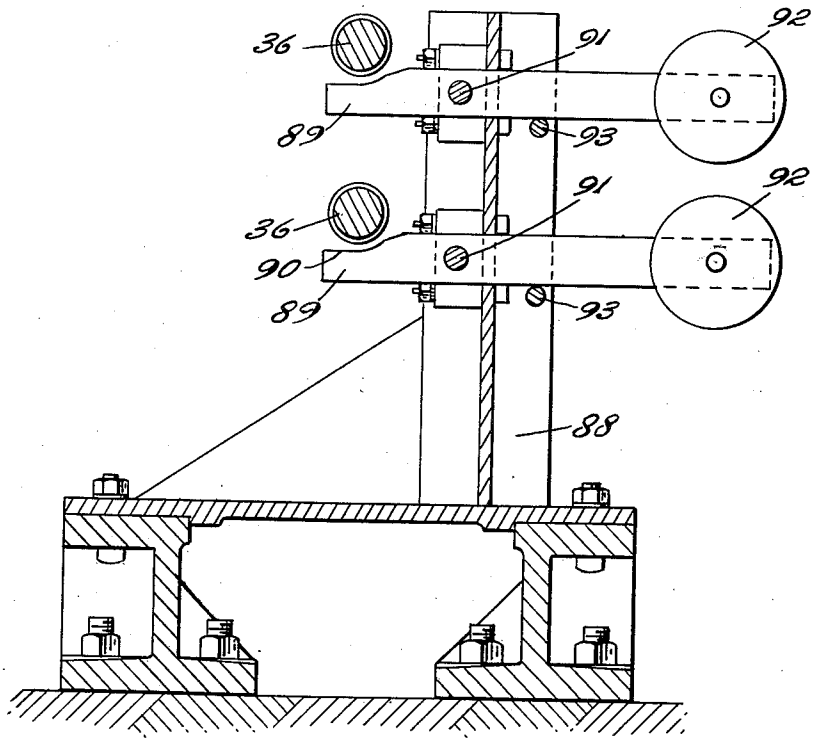
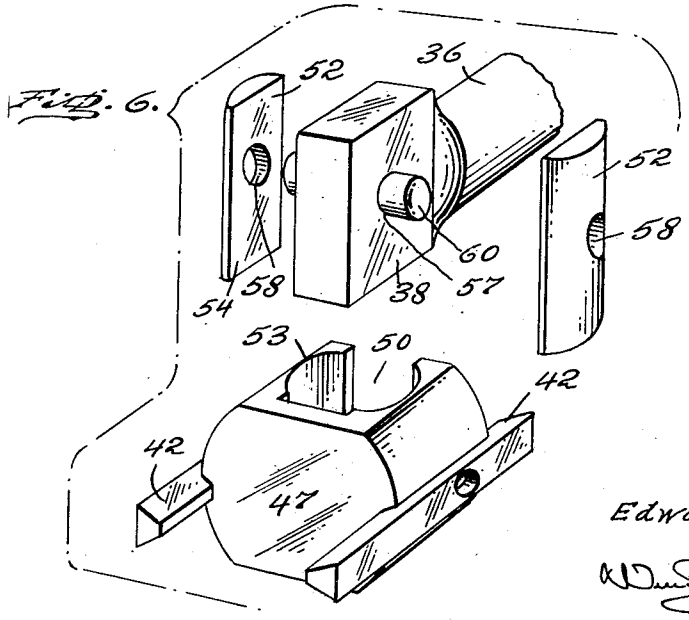


Fig. 6.



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United States Patent Office 2,697,335 Patented Dec. 21, 1954

2,697,335

ROLLING MILL SPINDLE AND COUPLING

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Application June 11, 1951, Serial No. 230,896

3 Claims. (Cl. 64—8)

The present invention relates to drives for devices in which rolls with variable center distances are driven from shafts with fixed center distances, and especially to couplings and spindles for rolling mills and the like.

A purpose of the invention is to facilitate the removal of a roll by making it possible to remove the coupling from the end of the roll while the roll is in normal position in the roll stand of a rolling mill.

A further purpose is to avoid the necessity of producing spade ends on rolls and pinion extensions or spindles.

A further purpose is to reduce the cost and increase the reliability and serviceability of spindle couplings.

A further purpose is to obtain sliding and universal joint action in the coupling at one end of a rolling mill spindle.

A further purpose is to obtain the universal action by opposed bearing blocks which externally conform to a cylindrical transverse surface of a coupling box and are internally flat and internally engage a squared or spade end on a spindle and pivotally connect the spade end of a spindle with the bearing blocks, so that the spindle can swing about its pivot in one plane and the bearing blocks can turn bodily in the transverse plane.

A further purpose is to anchor the ends of the bearing blocks against the ends of the cylindrical surface provided by an outer coupling box.

A further purpose is to provide resilient counter-balanced supporting arms beneath the spindles to prevent them from dropping when the couplings are removed from the rolls.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate one only of the numerous embodiments in which my invention may appear, selecting the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is a side elevation of a metal rolling mill to which the invention has been applied.

Figure 2 is an enlarged fragmentary partially broken side elevation of the spindle of Figure 1.

Figure 3 is a longitudinal section of Figure 2 on the line 3—3.

Figure 4 is an enlarged transverse section of Figure 2 on the line 4—4.

Figure 5 is an enlarged transverse section of Figure 2 on the line 5—5.

Figure 6 is a fragmentary exploded perspective of certain of the operating components of the coupling box at the gear end of the spindle.

Figure 7 is an enlarged fragmentary section of Figure 1 on the line 7—7.

Describing in illustration but not in limitation and referring to the drawings:

In the prior art, rolling mill rolls have been normally provided with spade ends and these have been connected through couplings with spade ends on the pinion extension. The couplings provide universal joint action but do not permit longitudinal movement of the character which would be necessary to remove the rolls. It is therefore usually necessary to move the rolls axially before they can be raised by the crane even in those mill housings which have removable caps and therefore would otherwise permit raising of the rolls directly in roll changing.

The manufacture of the spade ends and the rolls and extensions is expensive.

The present invention is concerned with facilitating roll changing by permitting the withdrawal of the spindle coupling from the end of the roll so that the roll can be removed immediately by vertical motion. Provision is also made in the invention for supporting the spindles when they are detached from the ends of the rolls.

In accordance with the invention it is no longer necessary to go to the expense of applying spade ends of the pinion extensions to the rolls. Ordinary cylindrical ends with keyways or set screw sockets can be employed.

The design of the coupling boxes has been simplified in accordance with the invention, the externally cylindrical bearing blocks engaging the exterior coupling box at the ends of the box, taking the torque at the ends as well as on the side surfaces of the blocks. This is a very simple and sturdy construction.

Provision has also been made for sliding and guiding the inner coupling box so as to minimize lost motion in the parts.

Figure 1 shows a rolling mill and its drives to which the invention may conveniently be applied.

A prime mover **20**, such as an electric motor, drives a shaft **21** on bearings **22** and is interconnected with a gear box **23** by couplings **24** and **25** of any well known character at opposite ends of a spindle **26**.

At the outer side of the gear box any suitable number of gear spindles or pinion extensions **27** is provided, in this case two being shown. It will be evident, however, that the number will depend upon the number of rolls in the mill, there being three gear spindles in a three high mill and two in a two high mill.

A roll stand **28** of any well known character is driven by the gear spindles. The roll stand is provided with rolls **30**. The roll stand is very desirably of the type which has removable caps so that the rolls can be lifted out vertically when the coupling boxes are removed.

On the gear spindles cylindrical ends **31** are provided having keyways **32**. The rolls are provided with cylindrical ends **33** having set screw recesses **34** as best seen in Figure 3.

Couplings **35** on the gear spindles or pinion extensions make universal joint connection to connecting spindles **36** at one end of each spindle and at the other end couplings **37** make universal joint connection between the rolls **30** and the respective connecting spindles **36**.

Each connecting spindle **36** has a squared or spade end **38** in the couplings at the opposite ends of the spindle.

Coupling **35** has an outer coupling box **40**, of exteriorly cylindrical contour, which is provided with interiorly cylindrical longitudinally extending guiding walls **41** which define an interior open space which is to receive the internal parts of the coupling box. At suitably opposed positions on the interior circumference of the outer coupling box **40**, keys **42** (preferably of bronze or similar bearing material) extend radially inwardly and are desirably mounted in longitudinally extending dovetail slots **43** in the interior surfaces of the coupling box **40**. At a central position the keys have grease openings **44** extending inwardly in line with grease fittings **45** in the box **40**.

At opposed positions on either side, the cylindrical surfaces **41** are longitudinally interiorly slotted at **46** as best seen in Figure 4 to receive and support the ends of the bearing blocks as later described.

A suitably bifurcated interior coupling box **47** is longitudinally slidably mounted in the coupling box **40**. The coupling box **47** has exteriorly cylindrical surfaces **48** at opposite sides which mate with and are slidably guided by the interior cylindrical surfaces **41** on the external coupling box **40**. The coupling box **47** also has longitudinal slots **49** which engage and guide on the keys **42**. The coupling box **40** has an interior open space **50** at the outer ends of the coupling which is provided with transversely extending internally cylindrical surfaces **51** best seen in Figure 3. The surfaces **51** engage in rockable relationship with bearing blocks **52** suitably of bearing material such as bronze having exteriorly cylindrical surfaces **53**.

Internally the bearing blocks **52** have flat chord-like surfaces **54** which swingably mate on the outsides of the squared or spade end **38** of the connecting spindle **36**. At the opposite ends **55** as best seen in Figure 4 the bear-

ing blocks are slidably engaged in the longitudinal slots **46** in the outer coupling box **40** so that the bearing blocks exert a supplemental keying action between the outer and the inner coupling box and slide with the inner coupling box as well as rocking with the spindle and permitting pivoting of the spindle.

The spade or squared end **38** of the connecting spindle **36** has a transverse opening **57**, and openings **58** in line therewith extend through the bearing blocks. A pivot pin **60** of length to terminate inside the bearing blocks extends through the openings **57** and **58** and pivots the connecting spindle **36** on the bearing blocks.

The inner coupling box has lubrication openings **61** in line with pin **60** and in normal position generally in line with lubrication openings **44** in the keys. Lubrication openings **61** are smaller than the pin so that the pin cannot become displaced to enter these openings.

The outer coupling box **40** has a keyway **62** which cooperates with keyway **32** in the gear spindle or pinion extension **31** and receives key **63** to hold the outer coupling box on the gear spindle.

To prevent entry of dust, the outer coupling box is closed at the end toward the connecting spindle by a cover **64** secured to the outer coupling box and having an opening **65** to pass the connecting spindle providing adequate freedom and equipped with a resilient dust seal **66**.

At the opposite end of the connecting spindle **36**, coupling **37** has an outer coupling box **67** suitably of cylindrical exterior form, and socketing the cylindrical end **33** of the roll. A set screw **68** removably attaches the coupling to the roll engaging in set screw recess **34**.

On the interior, the coupling box **67** is suitably made from a body **70** surrounded by and united as by welding to a sleeve **71**. Interiorly the body has opposite prongs **72** provided with a transversely extending cylindrical bore **73** which terminates against end blocks **74** united as by welding to the sleeve. Bearing blocks **75** similar to the bearing blocks already described have exteriorly cylindrical surfaces **76** which engage the cylindrical bore **73** and have internally flat or chord-like surfaces **77** which engage the squared or spade end **38** on the connecting spindle **36**. The bearing blocks are suitably of a bearing material such as bronze. A pivot opening **78** passes through the spade end and pivot openings **80** in the bearing box are in line with the pivot opening **78**. A pivot pin **81** extends through the openings **78** and **80** and terminates within the limits of the bearing blocks. Lubrication openings **82** are provided through the coupling box and lubrication fittings **83** connect therewith in line with the pin **81**.

At the open end of the coupling box a cover **84** is secured thereto having an opening **85** to pass the connecting spindle with adequate freedom and closed against dust by a resilient seal **86**.

The bearing blocks engage the inserts **74** of the coupling box at the ends at **87**.

At a point intermediate between the ends of the connecting spindles, a support stand **88** is provided as best seen in Figure 7. Supporting arms **89** extend out from the support stand **88** beneath the spindles and are suitably socketed at **90** to engage the spindles when they drop slightly. The arms are pivotally mounted at **91** on the stand and are counterbalanced to support the weight of the spindle by counterweights **92** at the ends remote from the spindles. Removable pins **93** beneath the arms limit the downward motion of the counterbalanced ends.

In operation when it is desired to remove the rolls, the set screws **68** are unscrewed, and the spindles and coupling boxes are detached from the rolls by sliding the inner coupling box to the left in the outer coupling box at the gear end until the roll coupling no longer surrounds the end of the roll. Pins **93** are removed before the spindle is slid clear of the roll, so that the counterweights will support the spindle and couplings as they are slid off and hold them up until the new rolls are in place. The spindle is then dropped or lowered to rest on the arm **89** and remains in that position while the rolls are changed, suitably by removing the caps of the roll stand as well known.

When the new rolls are in place, the spindles are readily aligned with the new rolls by pulling on arms **89**. The connecting spindles and the roll couplings are then moved to the right restoring the position shown in Figures 1, 2 and 3 and the set screws are reconnected to the new rolls.

The drive is then used as in the normal manner, the connecting spindles at each end pivoting on the pins and the bearing blocks swinging on an axis transverse to the pins as required by the extent of misalignment.

It will be understood that in accordance with the invention the bearing blocks laterally engage the spade ends of the connecting spindle and also at their ends engage the outer coupling box while at their outer circumferential surfaces they engage the cylindrical surfaces of the coupling box. There is thus a tortional support throughout the coupling.

In view of my invention and disclosure, variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a rolling mill, a gear spindle and a roll having opposed cylindrical ends, an outer coupling box removably mounted on the gear spindle and having an open cylindrical interior, an outer coupling box removably mounted on the roll, opposed to the outer coupling box on the gear spindle and having interior cylindrical surfaces extending transversely to the respective axes of the roll and the gear spindle, an inner coupling box longitudinally slidably mounted in the outer coupling box on the gear spindle and the inner coupling box on the gear spindle having interior cylindrical surfaces extending transversely to the respective axes of the roll and the gear spindle, bearing blocks having outer cylindrical surfaces engaging the inner cylindrical surfaces on the outer coupling box on the roll, bearing blocks having outer cylindrical surfaces engaging the inner cylindrical surfaces on the inner coupling box on the gear spindle and extending endwise beyond the inner coupling box to engage the interior of the outer coupling box on the gear spindle, the outer coupling box on the gear spindle having recesses which receive the ends of the bearing blocks, and a connecting spindle having spade ends pivoting respectively on the bearing blocks in the inner coupling box on the gear spindle and in the outer coupling box on the roll.

2. In a coupling, a shaft, an outer coupling box on the shaft having a longitudinal interior cylindrical surface, longitudinal interiorly extending keys on the interior cylindrical surface of the outer coupling box, an inner coupling box having exterior cylindrical surfaces which engage the interior cylindrical surfaces on the outer coupling box and having keyways which engage the keys, the inner coupling box having on each side interior cylindrical surfaces transverse to the axes of the shaft, there being at the ends of the cylindrical surfaces on each side slots in the outer coupling box which are in extension of the cylindrical surfaces, exteriorly cylindrical internally flat opposed bearing blocks engaging the cylindrical surfaces of the inner coupling box in opposed relation and engaging in the slots of the outer coupling box at the ends of the cylindrical surfaces, a spindle having a spade end engaging between the interior flat surfaces of the bearing blocks and a pivot pin extending transverse to the axis of the shaft through the bearing blocks and through the spade end of the spindle.

3. In a coupling, a shaft having a cylindrical end, an outer coupling box secured on and extending in prolongation of the end and having longitudinal grooves on the interior, guides positioned in certain of the longitudinal grooves, an inner coupling box positioned inside the outer coupling box, having exterior longitudinally extending grooves which receive and cooperate with the guides, and having transversely extending interior cylindrical surfaces, externally cylindrical and internally flat bearing blocks inside the inner coupling box, engaging the inner cylindrical surfaces of the inner coupling box and at the ends extending beyond the inner coupling box into engagement in certain of the longitudinal grooves on the inside of the outer coupling box, a spindle having a spade end extending into the inner coupling box in engagement with the inside surfaces of the bearing blocks and a pin passing through the bearing blocks and the spade end.

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