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REPLACEABLE MANDREL FOR TENSION REEL

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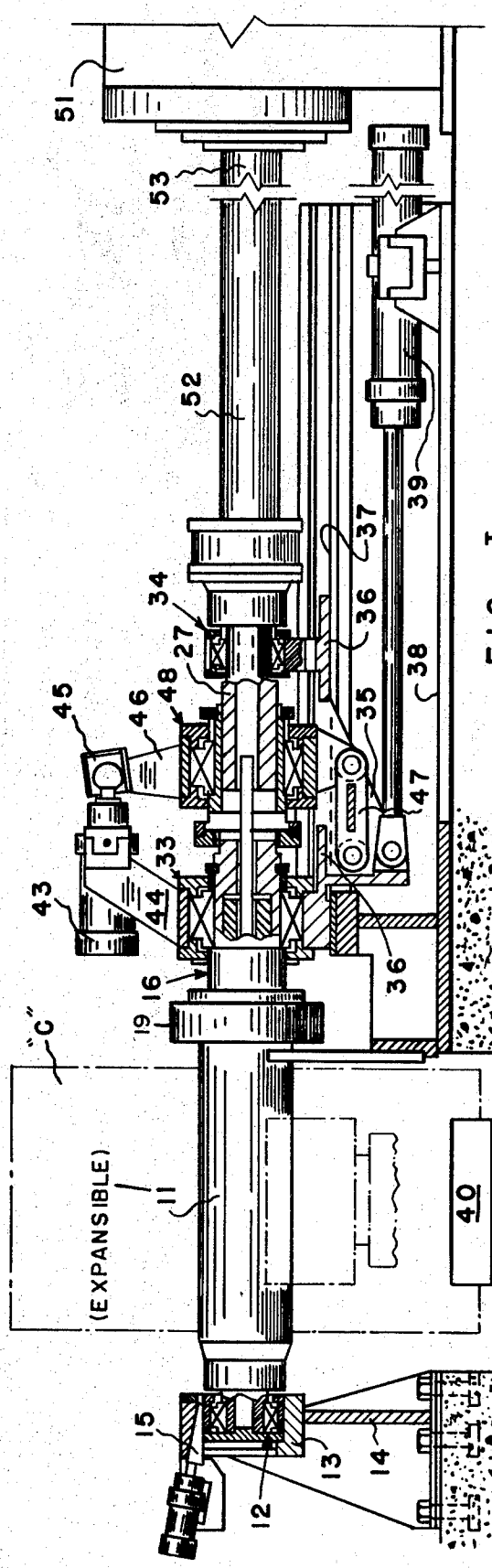

FIG. I

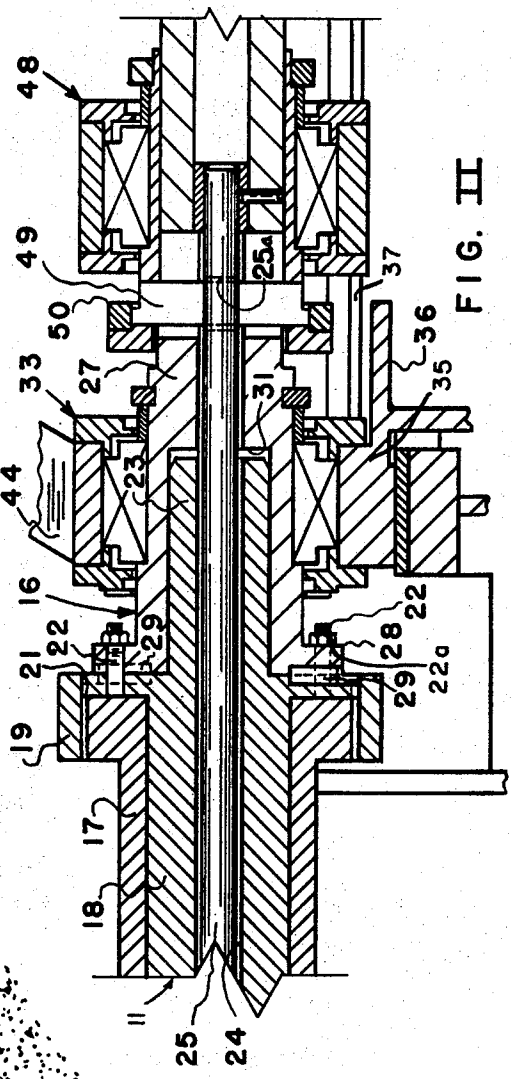

FIG. II

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REPLACEABLE MANDREL FOR TENSION REEL

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U.S. Cl. 242—78.1 8 Claims

ABSTRACT OF THE DISCLOSURE

The tension reel disclosed is designed to facilitate rapid replacement of the expandable mandrel as a unit through a construction of associated parts. The expandable mandrel has a flange at one end and an outboard bearing at the other end. Projecting outward from the flange is a stub shaft constructed to fit within a recess formed in a bearing mounted shaft that also has a flange adapted to be bolted and keyed to the mandrel flange in a driving relation. A rod extends axially from the mandrel a short distance into the bearing mounted shaft where it is connected to levers associated with a piston cylinder assembly for axially displacing the rod to expand the mandrel. The bearing mounted shaft is carried by a sled that is displaceable to remove the shaft from the mandrel while it is supported by a coil lift or other supporting means.

BACKGROUND OF THE INVENTION

A tension reel is conventionally employed to coil metallic strip delivered from a rolling mill as well as a strip processing line. Such a reel usually takes the form of an expandable mandrel constructed with an elongated arbor that is rotatably supported in a housing by bearings and carries a gear that meshes with a drive. Incident to employing such a tension reel presently there are at least two compelling reasons that necessitate quick replacement of the expandable mandrel. The first is to perform maintenance and service operations on the mandrel. In this regard, it is a laborious and time-consuming operation to disassemble the expandable mandrel for servicing and, therefore, a spare mandrel is used while the maintenance work is carried out on the original mandrel at some other location, such as a repair shop. This practice, although most economical in terms of lost production time of the rolling mill or processing line, is subject to a period of non-production depending upon the speed and ease at which mandrels can be substituted in the support structure.

Another area where it is highly advantageous to provide for the quick removal and replacement of mandrels is the case where the reel is designed to receive different diameter mandrels. When further processing of the newly-formed coils is carried out using different diameter uncoiling mandrels for certain of the coils, the period of non-production for the rolling mill or processing line is directly dependent upon the speed and ease at which mandrels can be substituted in the support structure.

Tension reel constructions known in the art are subject to certain disadvantages which the present invention is designed to overcome. With respect to replacing the expandable mandrel, in tension reel construction known in the art this generally takes the form of disassembling the drive housing to remove the extended shaft of the expandable mandrel along with the drive gear and anti-friction

bearing assemblies. This operation not only requires considerable time and effort to disassemble and reassemble the drive housing structure but also necessitates supplying and replacing an increased number of parts over that which is actually necessary to effect replacement of the mandrel per se.

A more recent form of reel construction known in the art and addressed to the problem of replacing expandable mandrels is disclosed in U.S. Pat. No. 3,294,338 issued on Dec. 27, 1966 to the assignee of the present invention. In this patent, the expandable mandrel is provided with an extended shaft adapted to fit tightly within a bearing mounted sleeve by providing tapered surfaces between the sleeve and mandrel shaft. For expanding the mandrel, a piston cylinder assembly is mounted on the free end of the extended shaft and connected to an actuating rod located in an axial bore through the shaft. While this reel construction represents a decided improvement over previous known constructions, it is subject to disadvantages not to be found in a tension reel constructed according to the present invention. In this respect, the mating tapered surfaces formed on the bearing mounted sleeve and the mandrel shaft become very tight and difficult to separate, particularly after a period of operation. Furthermore, the extended mandrel shaft with its tapered surfaces and axial bore along with the piston cylinder assembly for expanding the mandrel represent an added expense for each replacement mandrel which is not essential to replacement of the mandrel.

It is an object of the present invention to provide a tension reel construction designed to facilitate replacement of the expandable mandrel with a minimum of time and effort as well as requiring a minimum of duplicate parts.

It is a further object of the present invention to provide an improved tension reel construction wherein the expandable mandrel is releasably secured to an associated drive shaft by mating flanges.

It is another object of the present invention to provide an improved tension reel apparatus incorporating means to effect physical removal and replacement of the expandable mandrel from the associated support means.

These features and advantages, as well as others, will be better understood when the following description is read in light of the accompanying drawings, of which:

FIG. 1 is an elevational view, partly in section, of a tension reel incorporating the features of the present invention; and

FIG. 2 is an enlarged sectional view of a portion of the tension reel illustrated in FIG. 1.

With reference to FIG. 1, there is illustrated a tension reel for winding metallic strip into a coil "C." The tension reel includes an expandable mandrel **11** constructed in a manner, per se well known in the art. Mounted on the outboard end of the mandrel is a bearing assembly **12** constructed in any suitable manner and received within a housing **13** which forms part of a weldment **14** secured to the foundation by bolts. A wedge **15** actuated by a piston cylinder assembly is provided to releasably secure the bearing assembly to the housing **13**.

In accordance with the present invention, as best shown in FIG. 2, the mandrel **11** at its inboard end **16** is constructed in a manner to facilitate rapid replacement of the mandrel with respect to its associated drive and support means. The mandrel **11** at its inboard end **16** comprises a plurality of arcuate segments **17** disposed about

the outer surface of a support shaft **18**. Each of the segments **17** has an enlarged end received within a ring **19** in a well-known manner. The shaft **18** is constructed with a flange **21** which carries a plurality of bolts **22**. Projecting concentrically from the flange **1** is a short shaft or stud **23**. The shaft **18** and its stud **23** have an axial bore **24** into which there is located a rod **25** that is axially displaceable for the purpose of expanding the segments **17** of the mandrel.

A shaft assembly is provided for supporting and driving the mandrel. This assembly comprises a shaft **27** formed with a flange **28** to which the flange **21** is drivingly secured by keys **29** and the bolts **22** with nuts **22***a*. The shaft **27** at the flanged end has a recess **31** for receiving the stud **23** of the mandrel **11**. It is important to note that the stud **23** and the recess **31** extend into the shaft **27** only a short distance to a point where the stud can be supported by an anti-friction bearing block assembly **33** that, together with a bearing block assembly **34**, rotatably mounts the shaft **27**.

As best shown in FIG. 1, these bearing assemblies form part of a sled **35** which is constructed with horizontal projections **36** that are slidably supported in longitudinally arranged guideways **37** formed in a foundation mounted base **38**. The sled is provided with a downwardly extending projection to which is secured the rod end of a piston cylinder assembly **39** employed to traverse the sled, hence, also the shaft **27** supported by the bearing block assemblies **33** and **34**. During operation of the reel, the coil "C," during removal thereof, is supported by a coil lift **41** having a piston cylinder assembly **42** for elevating a support platen **40**. According to the present invention, the lift **41** is employed to support the mandrel **11** while the drive shaft **27** is retracted to effect replacement of the mandrel.

Actuating means are provided for expanding the mandrel **11** which comprises, as shown in FIGS. 1 and 2, a piston cylinder assembly **43** supported by arms **44** extending from the bearing block assembly **33**. A cross-head **45** interconnects the rod end of the piston cylinder assembly with one of the ends of spaced parallel arms **46**. These arms are pivotally secured at their opposite ends by links **47** to the extensions of the sled **35**. Trunnions, not shown, are used to connect the mid-points of the arms **46** to a bearing block assembly **48** which is slidably displaced along the shaft **27** by actuating the piston cylinder assembly **43**. The sliding movement of the bearing block **48** is transmitted to the actuating rod **25** of the mandrel by a bar **49** which passes through an elongated slot formed in the shaft **27** and through a narrow slot **25***a* in the rod **25**. The bar **49** is held captive to the bearing assembly **48** by a ring **50**, which is easily removable, to withdraw the bar **49** from the slot **25***a* in the rod **25**.

A drive **51** interconnects a motor, not shown, with the shaft **27** through a spindle **52**. The spindle has a splined end **53** that telescopes into and out of the drive when the drive shaft **27** is retracted relative to the mandrel.

When it is desired to substitute the expandable mandrel **11** with a replacement mandrel, the coil lift **41** is elevated by the piston cylinder assembly **42** until the platen **40** assumes a supporting relation with the mandrel, which position is shown by phantom lines in FIG. 1. The mandrel is then disconnected from the shaft **27** by moving the nuts **22***a* from the bolts **22** following which the bar **49** is removed from the actuating rods **25**. After this occurs, the piston cylinder assembly **39** is actuated to retract the shaft **27** from the mandrel **11** by traversing the sled **23** along the guideways formed in the base **26**. The mandrel will then be separated from the drive shaft **27** whereby a replacement mandrel can be substituted on the platen **40** by any suitable means, such as a crane. The replacement mandrel is then connected to the drive shaft by following the preceding operation in reverse. It is to be noted that the piston cylinder assembly actuated wedge **15**, in addition to securing the outboard bearing **12** to the support weldment **14** during the coiling operation, may also be employed to restrain the mandrel **11** from axial movement during the time the shaft **27** is being disengaged from the mandrel.

It is important to note that a tension reel constructed in accordance with the present invention permits replacement of the expandable mandrel without replacement of the bearing block assemblies **33** and **34** or the piston cylinder assembly **43** and its associated mechanisms for expanding the mandrel.

It will be appreciated by those skilled in the art that features of the present invention may be incorporated to other types of coiling or uncoiling reels other than a tension reel where it is desired to quickly replace the expandable mandrel.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof. However, I desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A reel for coiling metallic strip material having a mandrel adapted to be quickly removed from and replaced in the reel;

a drivable member formed on one end of said mandrel;

a drive shaft having a driving member at one end thereof constructed and arranged for connection to said drivable member;

disconnectable means for connecting said members in a driving relationship;

support means projecting from said one end of said mandrel;

a recess formed in said drive shaft for receiving said support means to at least partially support said mandrel during coiling of strip on said mandrel;

other means separate from said recess adapted to support said mandrel during removal and replacement thereof;

a sled for rotatably supporting said drive shaft;

a base for slidably supporting said sled; and

means for displacing said sled relative to said base for separating said drive shaft from said mandrel after said members are disconnected, whereby the weight of the mandrel is transferred from said recess to said other support means.

2. A reel according to claim **1** wherein said support means projecting from said mandrel takes the form of a stud shaft and said recess takes the form of a complementary opening, and wherein said reel includes means for rotatably supporting said mandrel at its end opposite said one end.

3. A reel according to claim **2** wherein said means for supporting said mandrel at its end opposite said one end comprises a bearing assembly mounted on said mandrel; and

a stationary support for said bearing assembly.

4. A reel according to claim **3** further comprising wedge means for releasably securing said bearing assembly to said stationary support during displacement of said sled relative to said base incident to removal of said mandrel.

5. A reel according to claim **2** further comprising:

an actuating rod extending from said stud shaft into said drive shaft for causing expansion of said mandrel; and

means carried by said sled and connected to said rod for expanding the mandrel.

6. A reel according to claim **1** comprising:

bearing means for rotatably supporting said drive shaft on said sled; and

means carried by said sled for causing the expansion of said mandrel.

7. A reel according to claim 1 further comprising:

first and second bearing assemblies rotatably supporting said drive shaft on said sled;

said first bearing assembly being disposed adjacent to said driving member; and

said second bearing assembly being remotely spaced from said first bearing assembly.

8. A reel according to claim 7 wherein said support means projects from said mandrel into said recess to at least the point where said first bearing means supports said drive shaft.

References Cited

UNITED STATES PATENTS

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NATHAN L. MINTZ, Primary Examiner