IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
WESTERN DIVISION
CASE NO. 7:00-CV-85-BR(1)

INTERROLL HOLDING AG,	)	
	)	
Plaintiff,	)	
	)	
v.	)	**AMENDED COMPLAINT**
	)	
SST BEARING CORPORATION	)	
	)	
Defendant.	)	

1. This is an action for patent infringement pursuant to 35 U.S.C. § 271. Jurisdiction is based on 28 U.S.C. § 1331 and 28 U.S.C. § 1338 (a). Venue is proper in this district under 28 U.S.C. § 1391(c) and § 1400(b).

2. Interroll Holding AG ("Interroll") is a corporation organized under the laws of Switzerland. Interroll Corp. is a subsidiary of Interroll and has its principal place of business in Wilmington, North Carolina.

3. Upon information and belief, SST Bearing Corporation ("SST") is a corporation having its principal place of business in Ohio. Upon further information and belief, SST has continuous and systematic business contacts within the State of North Carolina and this judicial district.

4. Interroll is the owner of U.S. Patent No. 5,421,442 (the '442 patent) for a conveyor roller with a tapered shuttle. A copy of the patent is attached as Exhibit 1.

5. Interroll is the owner of U.S. Patent No. 6,209,702 (the '702 patent) for a stub shaft conveyor roller. A copy of the patent is attached as Exhibit 2.

36

FIRST CLAIM
Patent Infringement of the '442 Patent

6. Interroll realleges paragraphs 1 through 5 of this Complaint.

7. Upon information and belief, SST manufactures a bearing insert and a conveyor roller with a bearing insert which are both sold, and/or offered for sale, by SST throughout the United States, including the State of North Carolina. Upon further information and belief, the bearing insert and conveyor roller with bearing insert directly infringe one or more claims of the '442 patent.

8. Upon information and belief, SST sells its bearing inserts to others for use in the manufacture of conveyor rollers. Upon further information and belief, the customers of SST use the bearing insert to manufacture conveyor rollers that infringe one or more claims of the '442 patent.

9. The bearing insert, upon information and belief, is especially made, or especially adapted, for use in rollers, which infringe the '442 patent, is not a staple article or commodity of commerce, and does not have any substantial non-infringing uses.

10. Upon information and belief, SST has sold, and/or offered to sell, the bearing insert that is an infringement of the '442 patent and is, therefore, liable as a contributory infringer.

11. Upon information and belief, SST has induced others to infringe the '442 patent and is, therefore, liable for the infringement.

12. Upon further information and belief, SST continues to sell bearing inserts and conveyer rollers knowing that such products infringe the '442 patent.

SECOND CLAIM
Patent infringement of the '702 Patent

13. Interroll realleges paragraphs 1 through 12 of this Complaint.

14. Upon information and belief, SST manufactures bearing inserts and conveyor rollers with a bearing insert which are both sold, and/or offered for sale by SST throughout the United States, including the State of North Carolina. Upon further information and belief, the bearing inserts and conveyor rollers with a bearing insert directly infringe one or more claims of the '702 patent.

15. Upon further information and belief, SST continues to sell bearing inserts and conveyer rollers knowing such products infringe the '702 patent.

WHEREFORE, Interroll Holding AG and Interroll Corporation pray that this Court grant the following relief:

1. That SST be enjoined from making, using, selling, or offering to sell the bearing insert and conveyor roller that directly infringe the '442 patent and the '702 patent;

2. That SST be enjoined from making, using, selling, or offering to sell the bearing insert or any other insert especially adapted for use in rollers that infringe the '442 patent and the '702 patent;

3. That SST be ordered to pay damages on profits lost by Interroll as a result of the infringement of its patent or, at a minimum, pay damages equal to a reasonable royalty on all bearing inserts sold by SST;

4. That the Court find the infringement by SST of the '442 patent and the '702 patent to be willful.

5. That the Court award Interroll its costs and reasonable attorneys fees; and

6. Such other relief as the Court may deem just and proper.

Demand for Jury Trial

Plaintiff, Interroll Holding AG, herein demands a jury trial on all issues allowable by law.

This the 5th day of April, 2001.

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US005421442A

United States Patent [19]

Agnoff

[11] Patent Number: 5,421,442

[45] Date of Patent: Jun. 6, 1995

[54] **ROLLER WITH TAPERED SHUTTLE**

[75] Inventor: **Charles Agnoff**, Wilmington, N.C.

[73] Assignee: **Interroll Holding, A.G.**, San Antonio

[21] Appl. No.: **275,443**

[22] Filed: **Jul. 15, 1994**

[51] **Int. Cl.**[6] **B65G 13/00**

[52] **U.S. Cl.** ..... **193/37**; 193/35 R

[58] **Field of Search** ..... 198/500, 501, 780, 842, 198/860.1, 861.1; 193/35 R, 37

[56] **References Cited**

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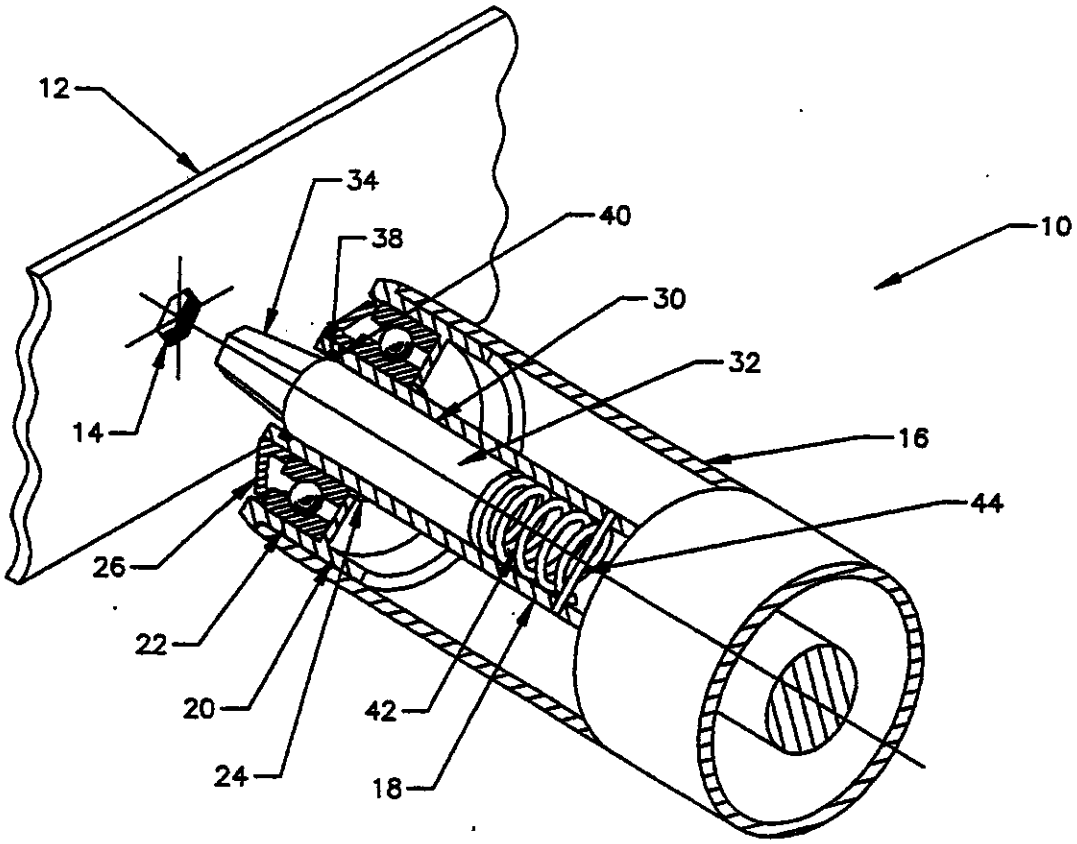
Primary Examiner—James R. Bidwell

Attorney, Agent, or Firm—Rhodes, Coats & Bennett

[57] **ABSTRACT**

A roller for a conveyor comprises a roller shaft, a generally cylindrical roller tube rotatably mounted to the roller shaft, and an axially moveable shuttle disposed at one end of the roller shaft. The shuttle is moveable between an extended position and a retracted position. A spring biases the shuttle to the extended position. The shuttle has a tapered-end portion which mates with a mounting hole in a frame member supporting the roller. The spring urges the tapered-end portion of the shuttle into engagement with the mounting hole in the frame so as to eliminate play between the shuttle and the mounting hole.

22 Claims, 7 Drawing Sheets



EXHIBIT

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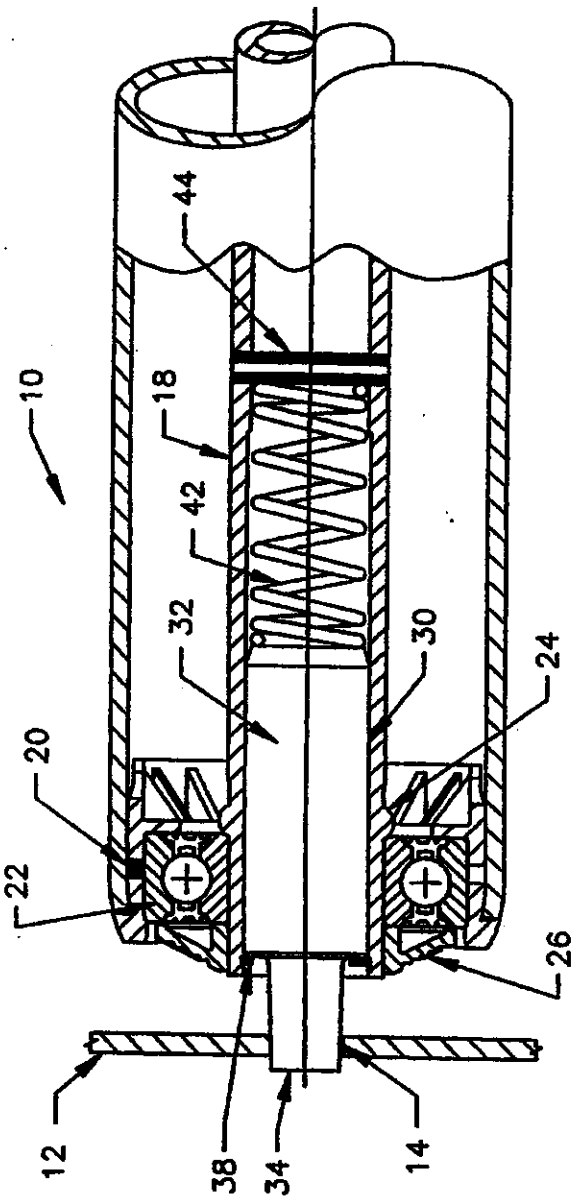


FIGURE 1

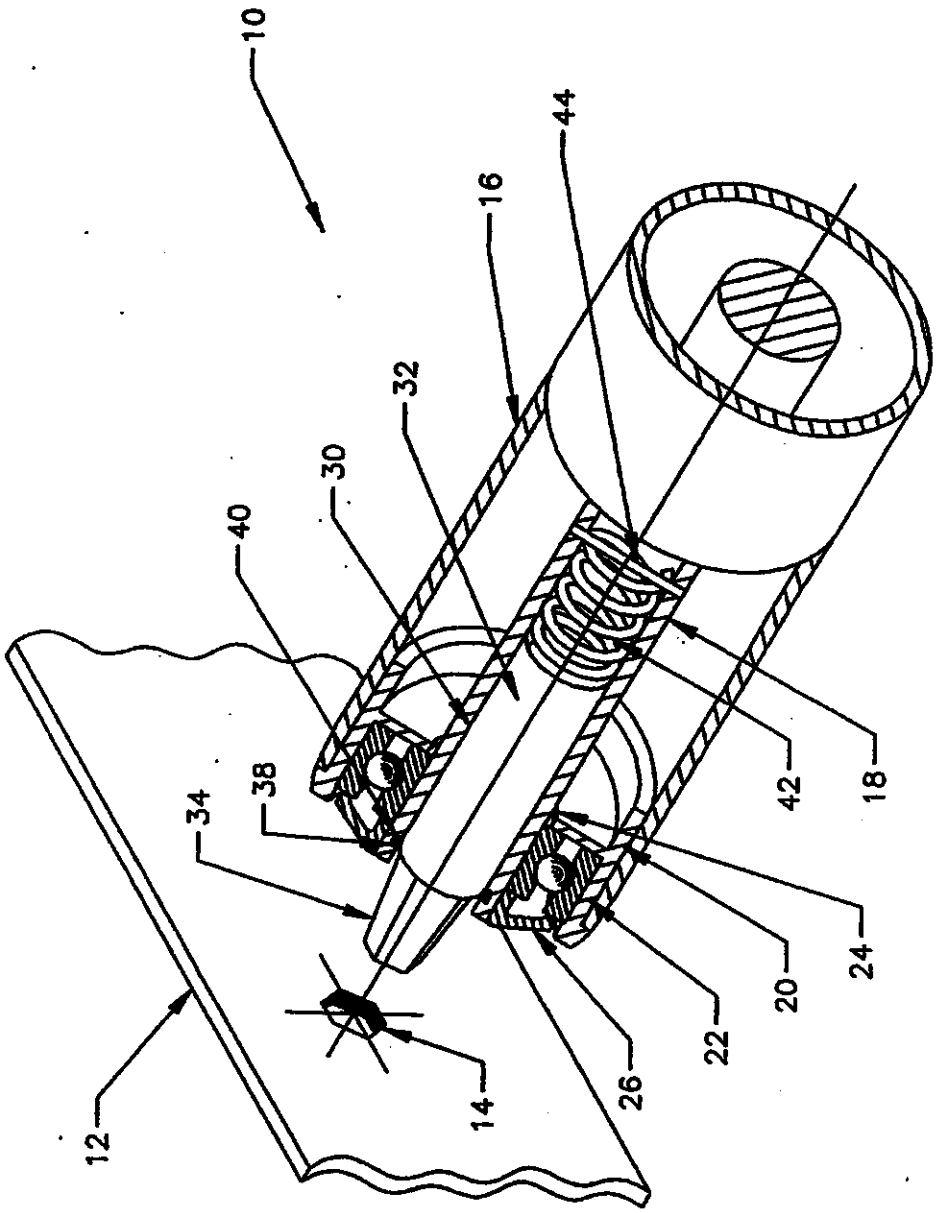


FIGURE 2

FIGURE 3

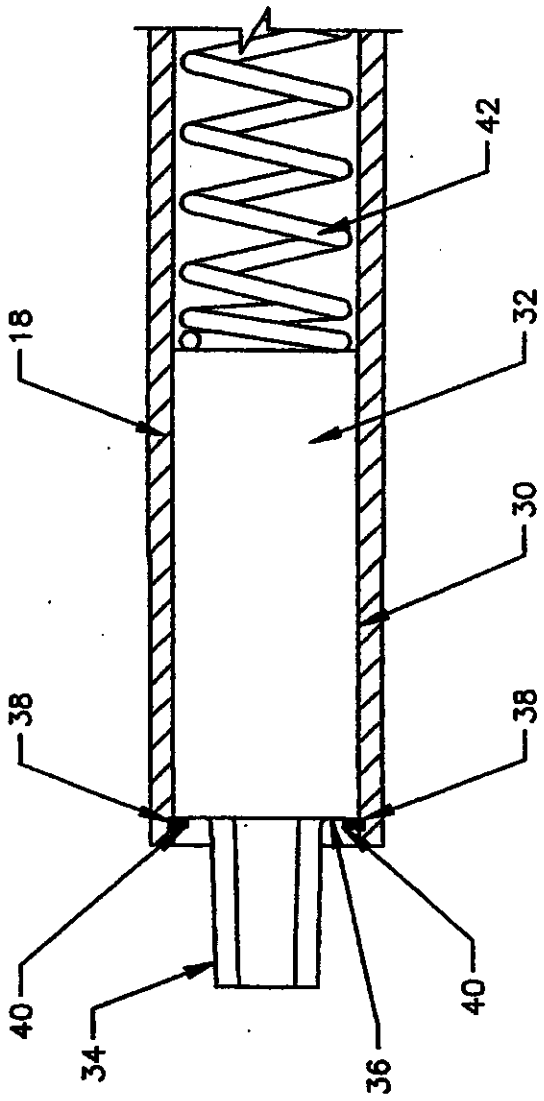
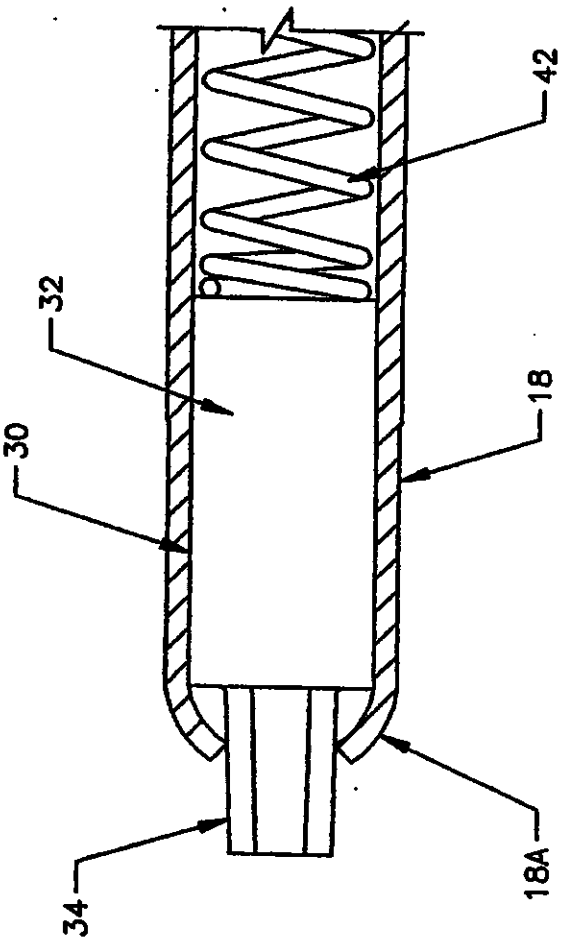


FIGURE 4A



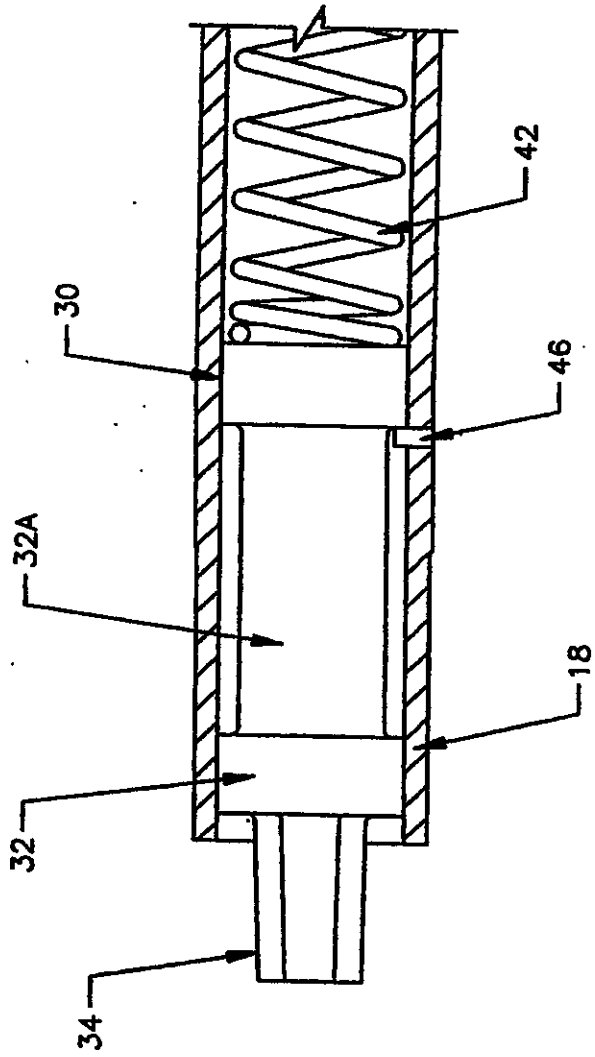


FIGURE 4B

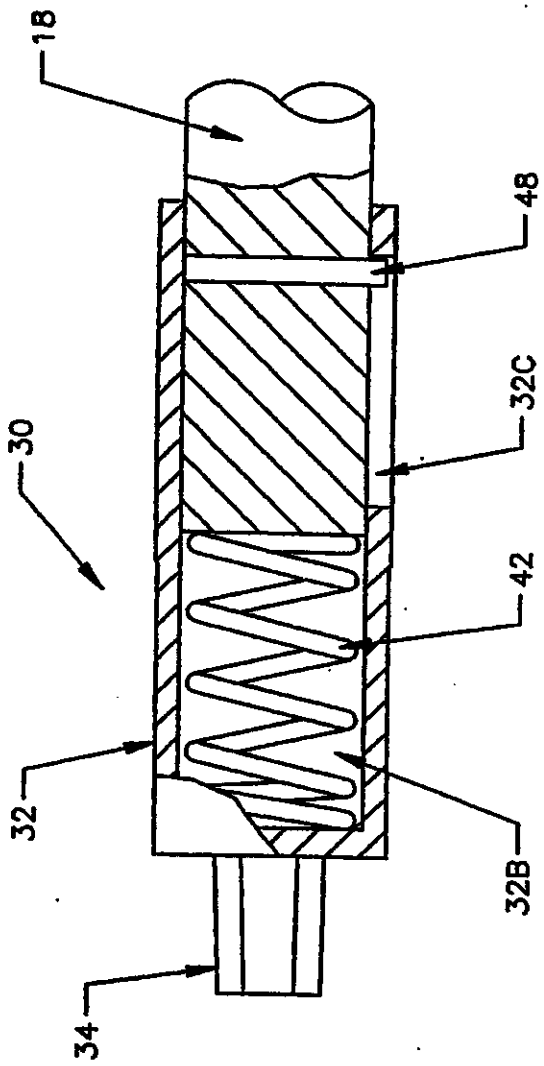


FIGURE 5

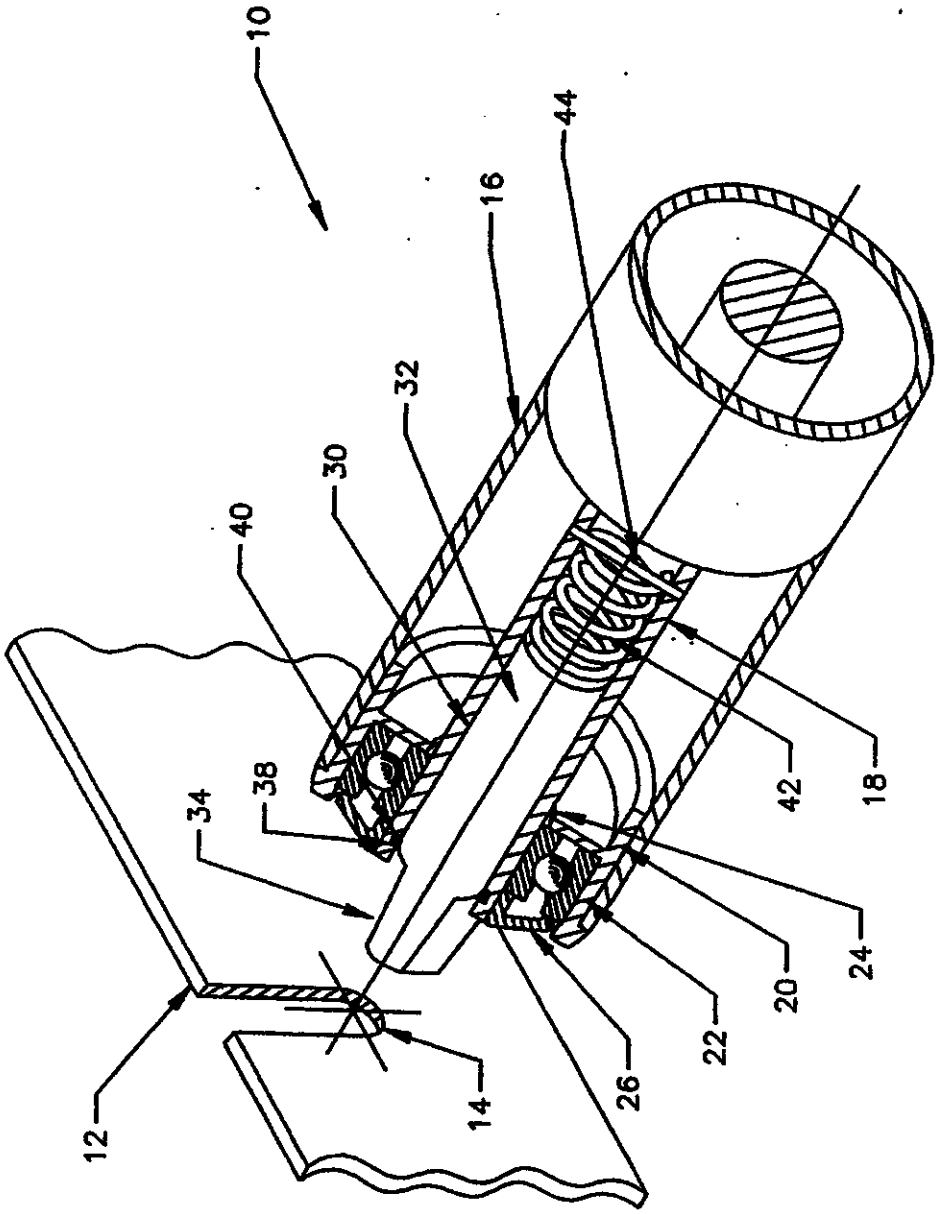


FIGURE 6

ROLLER WITH TAPERED SHUTTLE

FIELD OF THE INVENTION

The present invention relates generally to improvements in rollers for roller conveyors and, more particularly, to a roller for a roller conveyor having spring loaded shafts.

BACKGROUND OF THE INVENTION

Rollers are frequently used in conveyors, packaging machinery, treadmills, and linear motion material handling devices. Rollers are typically mounted on fixed centers between parallel frames which provide adequate support for the rollers and the articles transported by the rollers. Various methods exist for mounting the rollers in the support frames. One of the most common methods is to use a roller having a spring-loaded shaft. The shaft is extended on both ends of the roller. To install the roller, the shaft is moved axially against the force of the spring and "snaps" in place between the parallel frame members into a suitable hole or slot.

In order to prevent rotation of the shaft in the frame, which could result in substantial wear, the roller shaft and the mating mounting holes or slots in the frame have a polygonal configuration to prevent rotation. For example, the shaft and the mating mounting holes could be hexagonal in shape. Alternatively, when round shafts are used, one or more flats may be formed on the shaft to prevent rotation of the shaft in the frame.

In order to accommodate the tilt angle required to install a spring loaded roller into mounting holes, the mounting holes in the frame are generally 0.030 inches to 0.068 inches oversized to facilitate assembly. Alternatively, if mounting slots are used, the width of the slots are similarly oversized. In most applications, the resulting "play" between the shaft and the mounting hole in the frame presents no operating difficulties. However, in powered conveyors where vibration and side movement can occur, there is a tendency for the shaft to vibrate in the mounting hole causing wear and creating excessive noise. If the mounting hole in the frame wears excessively, it is possible that the shaft will start to rotate in its mounting hole. This unintended rotation of the shaft may lead to premature failure of the roller and/or shaft as well as the frame.

In powered conveyors, the shaft wear problem is exacerbated when the rollers rotate at high speed. Most conveyor rollers utilize welded-steel tubing. Differences in wall thickness of the tube around its circumference as well as a weld seam inside the tube may result in roller tube imbalance. This roller tube imbalance is not a problem in slow speed applications. However, at high speeds, the dynamic imbalance of the tube causes the roller and the shaft to oscillate in the frame mounting hole causing noise and accelerating wear.

Accordingly, there is a need for a roller mounting method which eliminates the play between the roller shaft and the mounting holes in the frame so that excessive wear is prevented.

SUMMARY AND OBJECTS OF THE INVENTION

The present invention provides an improved method for mounting a conveyor roller between parallel frame members. The roller includes a cylindrical tube which is rotatably mounted on a roller shaft. The roller shaft includes a spring-loaded shuttle at one or both ends of the roller shaft. This shuttle has a tapered end portion which engages the mounting holes in the frame members to eliminate play between the shaft and the mounting hole. Preferably, the tapered end portion of the shuttle and its mating mounting hole are shaped to prevent rotation of the shaft. For example, the cross section of the shuttle may be hexagonal, square, or round with one or more flats.

Depending upon the roller design and frame configuration, several alternative shuttle arrangements may be used. The shuttle may be contained in an axial opening in the end of a solid roller shaft or tubular shaft. Alternatively, the shuttle itself may include an axial opening which receives the end of the roller shaft. The shuttle can be retained on the shaft by the use of retaining rings, crimps, pins, or supplementary fasteners.

Other objects and advantages of the present invention will become apparent and obvious from a study of the following description and the accompanying drawings which are merely illustrative of such invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-section of the conveyor roller of the present invention;

FIG. 2 is a perspective view of the conveyor roller;

FIG. 3 is a detail section view showing the roller shaft and shuttle;

FIGS. 4*a* and 4*b* are detail section views showing alternate methods for retaining the shuttle within the roller shaft; and

FIG. 5 is a detail section view showing an alternate arrangement for the shuttle.

FIG. 6 is a perspective view of an alternate embodiment of the conveyor roller for use with open-ended mounting slots.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, and particularly to FIGS. 1 and 2, the conveyor roller of the present invention is shown therein and indicated generally by the numeral 10. The roller 10 is adapted for use in conveyors, packaging machinery, treadmills, and linear motion material handling devices. The roller 10 is mounted between parallel frame members 12 which support the roller 10 at opposite ends thereof. Each frame member 12 has a series of mounting holes 14 formed therein for mounting the roller 10. The present invention is particularly related to an improved mounting system for mounting the roller 10.

The roller 10 comprises a generally cylindrical roller tube 16 which is rotatably mounted on a roller shaft 18. In the disclosed embodiment, the roller shaft 18 comprises a hollow tube. An end cap 20 is fit into the end of the roller tube 16 and houses a bearing 22. The bearing 22 is retained by friction within the end cap 20. The roller shaft 18 extends through the end cap 20 and is journaled within the bearing 22. An annular ridge 24 is formed on the outer surface of the roller shaft 18 which engages the bearing 22 to prevent axial movement of the roller shaft 18. A bearing shield 26 fits over the end of the roller shaft 18 and covers the bearing 22 to protect the bearing 22 from particulate contamination.

The roller 10 is mounted between the frame members 12 by means of an axially moveable shuttle 30 at one or both ends of the roller shaft 18. The shuttle 30 is adapted to engage a corresponding mounting hole 14 in

one of the frame members 12. As shown in FIG. 3, the shuttle 30 is disposed within the hollow roller shaft 18. The shuttle 30 includes a generally cylindrical body 32 and a tapered end portion 34. The body 32 of the shuttle 30 is sized to slide freely within the roller shaft 18. The tapered end portion 34 is narrower than the diameter of the cylindrical body 32 so that a shoulder 36 is formed at the junction of the body 32 and the tapered end portion 34. The tapered end portion 34 preferably has a polygonal configuration. In the disclosed embodiment, the end portion 34 of the shuttle 30 has a hexagonal configuration. The mounting holes 14 of the frame members 12 have a similar configuration so that rotation of the shuttle 30 in the mounting hole 14 is prevented by the mating geometry.

The shuttle 30 is retained within the roller shaft 18 by a snap ring 38. The snap ring 38 fits into an annular groove 40 formed on the inner surface of the roller shaft 18. The snap ring 38 engages the shoulder 36 on the shuttle body 32 to retain the shuttle 30 within the roller shaft 18.

The shuttle 30 is biased by a spring 42 to an extended position as shown in FIG. 1. One end of the spring 42 engages the bottom of the shuttle 30. The opposite end of the spring 42 pushes against a pin 44 that extends diametrically through the roller shaft 18. The spring 42 is slightly compressed so that the spring 42 always exerts a force against the shuttle 30 urging the shuttle 30 to an extended position.

The tapered surfaces on the end portion 34 of the shuttle 30 eliminate any play between the shuttle 30 and its mating mounting hole 14. The spring 42 will always urge the shuttle 30 outwardly until the tapered surfaces of the end portion 34 seat against the edges of mounting holes 14. To function properly, the width of the tapered end portion 34 must be less than the corresponding dimension of the mounting hole 14 at the outer end thereof and wider than the corresponding dimension of the mounting hole 14 at its base. For example, if the mounting hole 14 is ½' in width, the tapered end portion 34 of the shuttle 30 must be less than ½' of its outer end and greater than ½' at its base. The tapered end portion 34 will seat in the mounting hole 14 at some point between the base and the end where the cross-sectional area of the end portion 34 matches the mounting hole 14.

To install the roller 10 between parallel frame members 12, the roller 10 is held in a tilted position while one end of the roller shaft 18 is inserted into its mating mounting hole 14. After the first end is inserted into its mating mounting hole 14, the shuttle 30 is pressed to move the shuttle 30 to a retracted position. The second end is then lowered between the frame members 12 until the roller shaft 18 is aligned with its mating mounting hole 14 of the frame member 12. When the roller shaft 18 is aligned with the mounting hole 14, the spring 42 urges the shuttle 30 back to the extended position and the tapered end 34 of the shuttle 30 fully engages the mounting hole 14 in the frame member 12. The combination of the spring 42 and the tapered end 34 of the shuttle 30 eliminates any play between the shuttle 30 and the mounting hole 14. As a result, vibration and movement of the roller shaft 18 is substantially reduced.

Referring now to FIGS. 4*a* and 4*b*, alternate methods are shown for retaining the shuttle 30 within the roller shaft 18. In FIG. 4*a*, the roller shaft 18 includes a crimped end 18*a* which retains the shuttle 30 within the roller shaft 18. In FIG. 4*b*, the shuttle body 32 is formed with a narrow section 32*a*. A retaining pin 46 inserted through an opening in the roller shaft 18 extends into the annular space surrounding the narrow section 32*a* to limit the axial movement of the shuttle 30 in two directions.

In FIG. 5, an alternate design is shown for the shuttle 30. In the design shown in FIG. 5, the roller shaft 18 is solid and an axial opening 32*b* is formed in the shuttle body 32. The shuttle 30 slides over one end of the roller shaft 18. The shuttle 30 is retained on the shaft 18 by a pin 48 which extends into a slot 32*c* in the shuttle body 32. The biasing spring 42 is disposed in the axial opening 32*b*. The external shuttle 30 shown in FIG. 5 operates the same as the internal shuttle 30 shown in FIG. 1.

FIG. 6 shows a conveyor roller adapted to mount into open-ended slots in the frame 12. The tapered end 34 of the shuttle 30 has a generally circular cross-section with two opposed flats. The flats are tapered as previously described. The tapered end 34 of the shuttle 30 fits into the open-ended slot in the frame 12. The tapered end 34 can be easily inserted into the slot by pressing on the end of the shuttle 30 allowing it to slide downwardly into the slot. When the pressure on the end of the shuttle 30 is released, the shuttle 30 is biased by the spring 42 into engagement with the edges of the slot.

The embodiment shown in FIG. 6 provides a safety feature in applications where the roller is driven by some external means, such as a belt. If a person's clothing or body part gets trapped between the roller 10 and the drive belt, the roller 10 will be lifted upwardly in the slot allowing the person to extract his clothing or body part without serious injury.

Based on the foregoing, it is apparent that the roller mounting system of the present invention eliminates many problems associated with prior art designs related to vibration and movement of the roller 10. The shuttle design eliminates any play between the shuttle 30 and its mating mounting hole 14. As a result, there is significantly less vibration when the roller 10 is used, even in high speed applications. Thus, the design substantially reduces wear such that cost of operation is decreased. Further, the present invention substantially reduces the risk of failure during operation of the roller 10.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. A roller for a conveyor comprising:

(a) a roller shaft;

(b) a generally cylindrical roller tube rotatably mounted to said roller shaft;

(c) a shuttle mounted at one end of said roller shaft, said shuttle being movable along the axis of the roller shaft between an extended position and a retracted position, wherein the shuttle includes a tapered end portion adapted to be inserted into a similarly shaped mounting hole in a frame member, the tapered end portion being wider at one section than the mounting hole and tapering to an outer end that is narrower than the mounting hole; and

(d) wherein when the shuttle is moved to the extended position, the tapered end portion seats within the mounting hole in said frame member.

2. The roller according to claim 1 wherein the tapered end portion of said shuttle is shaped to prevent rotation of the shuttle relative to the mounting hole.

3. The roller according to claim 1 further including a biasing member disposed to urge the shuttle to an extended position.

4. The roller according to claim 1 wherein the roller shaft has an axial opening at one end thereof and wherein the shuttle is disposed within the axial opening of the roller shaft.

5. The roller according to claim 4 wherein the roller shaft is a hollow tube.

6. The roller according to claim 4 Wherein the biasing member is disposed within the axial opening in said roller shaft.

7. The roller according to claim 4 further including retaining means for retaining the shuttle within said axial opening in the roller shaft.

8. The roller according to claim 7 wherein the retaining means includes an annular groove formed on an inner surface of said axial opening and a retaining ring insertable into said annular groove.

9. The roller according to claim 7 wherein the retaining means comprises a retaining pin extending axially through the roller shaft for engaging the shuttle.

10. The roller according to claim 7 wherein the roller shaft is crimped at one end thereof to retain the shuttle within the axial opening.

11. A conveyor assembly including:

(a) a pair of generally parallel frame members having a series of longitudinally spaced openings formed therein;

(b) one or more rollers disposed between said parallel frame members, said rollers including a stationary roller shaft and a roller tube rotatably mounted on said roller shaft; and

(c) mounting means for mounting said roller between said parallel frame members, said mounting means including a shuttle mounted for axial movement along said roller shaft between an extended position and a retracted position, said shuttle including a tapered end portion for engaging a corresponding opening in one of said frame members, the tapered end portion having one section that is wider than the opening and gradually tapering to an outer end that is narrower than the opening.

12. The conveyor assembly of claim 11 wherein said mounting means further includes a biasing member disposed to urge the shuttle to an extended position.

13. The conveyor assembly according to claim 11 wherein the tapered end portion of said shuttle is shaped to prevent rotation of the shuttle relative to the corresponding opening in said frame member.

14. The conveyor assembly according to claim 11 wherein the roller shaft has an axial opening at one end thereof and wherein the shuttle is disposed within the axial opening of the roller shaft.

15. The conveyor assembly according to claim 14 wherein the roller shaft is a hollow tube.

16. The conveyor assembly according to claim 14 wherein the biasing member is disposed within the axial opening in said roller shaft.

17. The conveyor assembly according to claim 14 further including retaining means for retaining the shuttle within said axial opening in the roller shaft.

18. The conveyor assembly according to claim 17 wherein the retaining means includes an annular groove formed on an inner surface of said axial opening and a retaining ring insertable into said annular groove.

19. The conveyor assembly according to claim 17 wherein the retaining means comprises a retaining pin extending axially through the roller shaft for engaging the shuttle.

20. The conveyor assembly according to claim 17 wherein the roller shaft is crimped at one end thereof to retain the shuttle within the axial opening.

21. The conveyor assembly of claim 11 wherein the opening in said frame member comprises a vertically-extending slot to permit vertical movement of the roller within said slot.

22. The conveyor assembly of claim 21 wherein said slot is open at one end.

* * * * *

US006209702B1

(12) **United States Patent**
Agnoff

(10) **Patent No.: US 6,209,702 B1**
(45) **Date of Patent: Apr. 3, 2001**

(54) **STUB SHAFT CONVEYOR ROLLER**

(75) Inventor: **Charles Agnoff**, Wilmington, NC (US)

(73) Assignee: **Interroll Holding AG**, San Antonino (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/560,484**

(22) Filed: **Apr. 28, 2000**

Related U.S. Application Data

(63) Continuation of application No. 08/939,966, filed on Sep. 29, 1997, now Pat. No. 6,076,647.

(51) **Int. Cl.**[7] **B65G 39/00**
(52) **U.S. Cl.** ..... **193/37**; 193/35 R; 198/780
(58) **Field of Search** ..... 193/37, 35 R; 198/780; 384/215, 130, 144, 225

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6,076,647	*	6/2000	Agnoff	193/37

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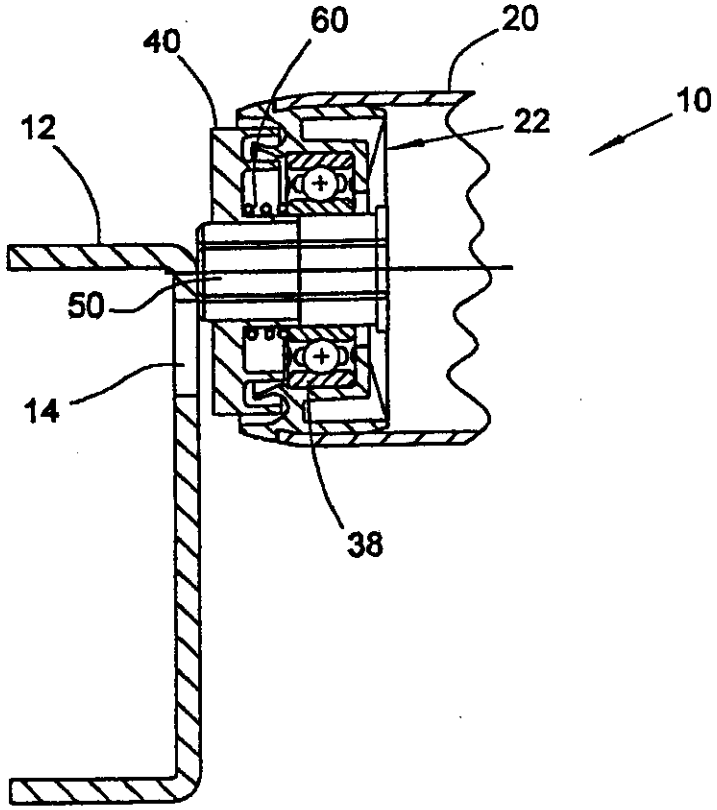
Primary Examiner—Joseph E. Valenza
Assistant Examiner—Mark A. Deuble
(74) *Attorney, Agent, or Firm*—Coats & Bennett, PLLC

(57) **ABSTRACT**

A conveyor roller includes a generally cylindrical roller tube and a pair of stub shafts rotatably mounted in each end thereof. At least one of the stub shafts is mounted for axial movement between an extended position and a retracted position. When in the extended position, the stub shafts on each end of the conveyor engage respective mounting holes in the conveyor frame. To insert the conveyor roller in the conveyor frame, the movable stub shaft is moved to a retracted position while the roller is lowered into the conveyor frame. When the stub shaft aligns with the mounting holes in the conveyor frame, the stub shaft is urged back to the extended position by a biasing member to engage the mounting hole in the conveyor frame.

11 Claims, 4 Drawing Sheets



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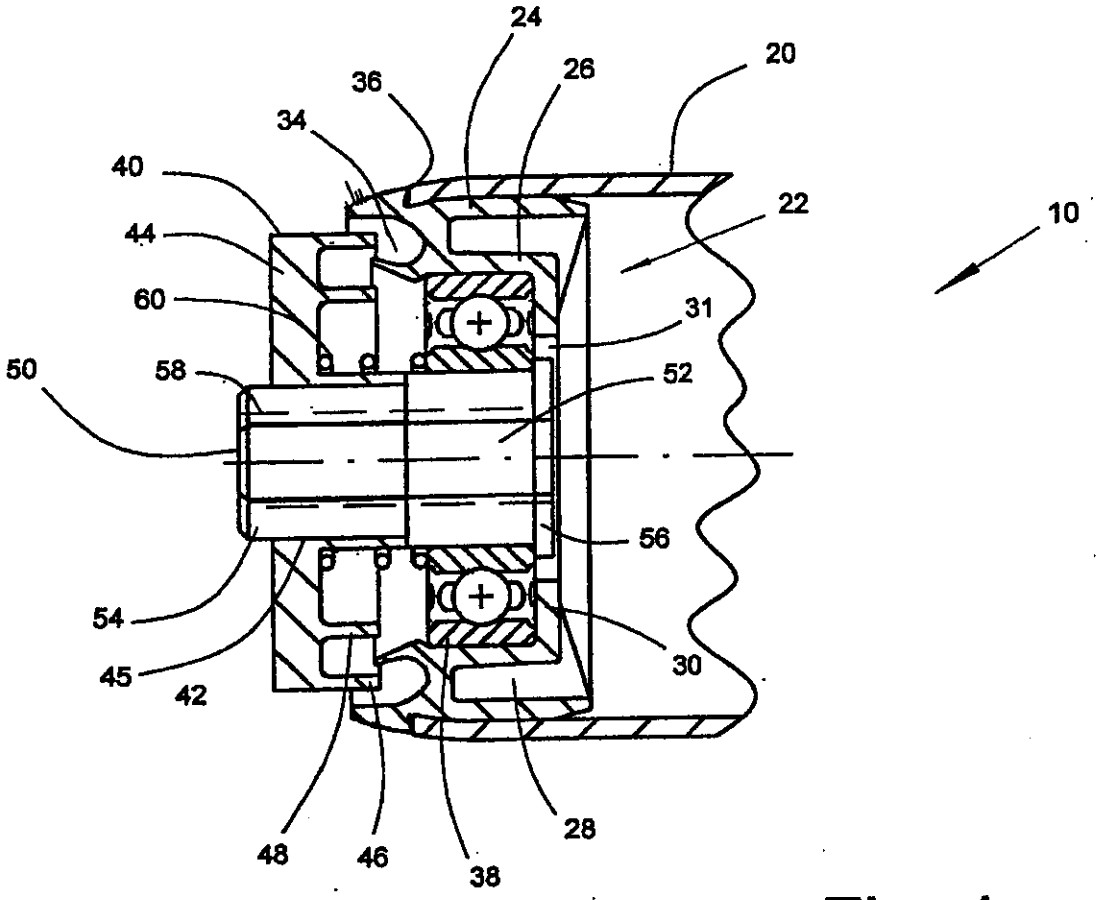

Fig. 1

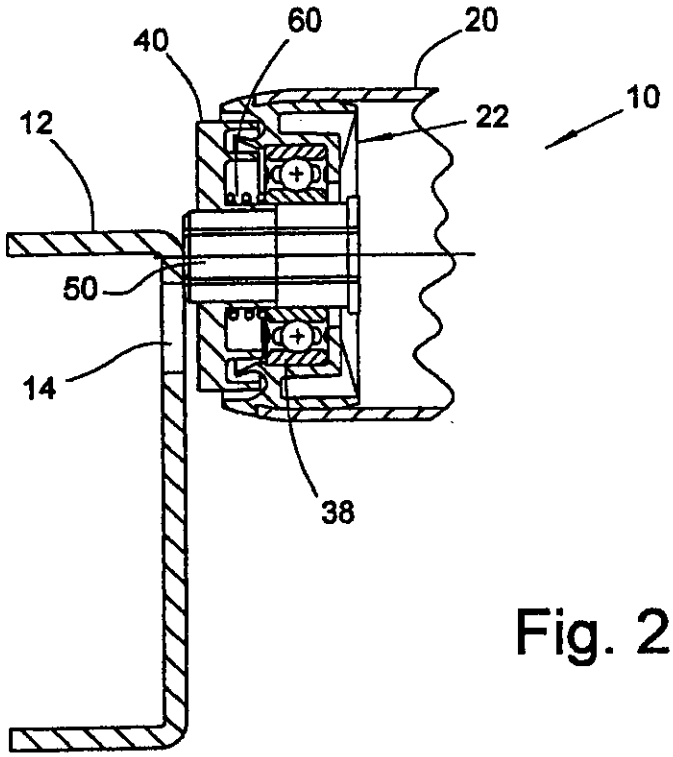

Fig. 2

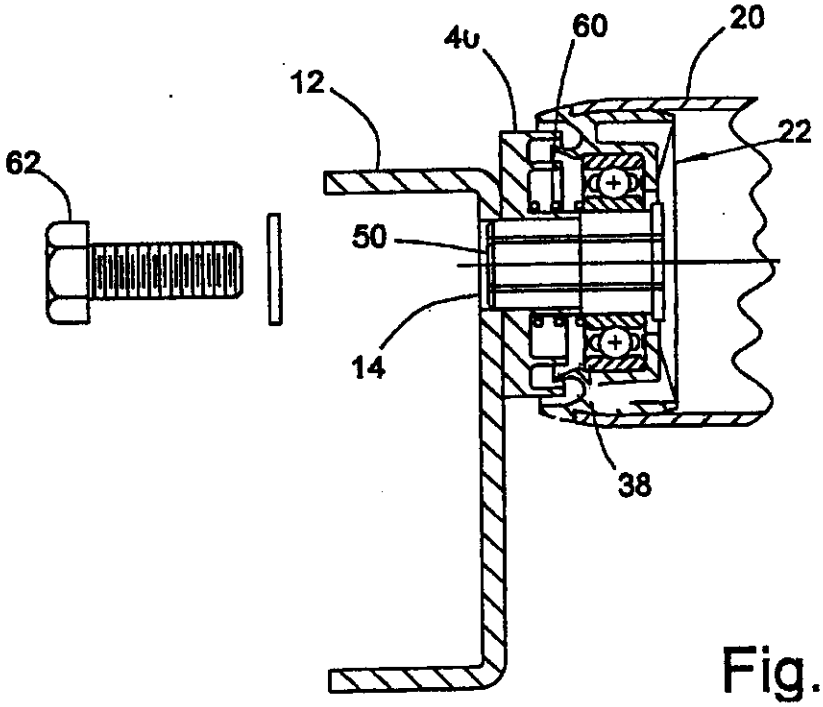

Fig. 3

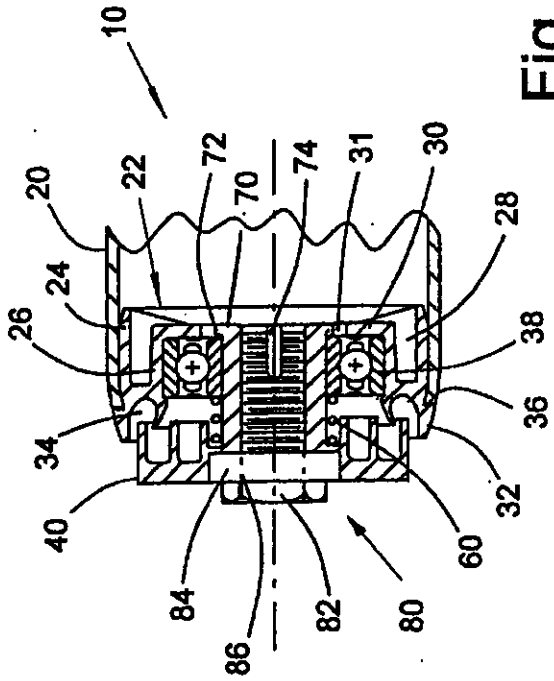
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Fig. 5

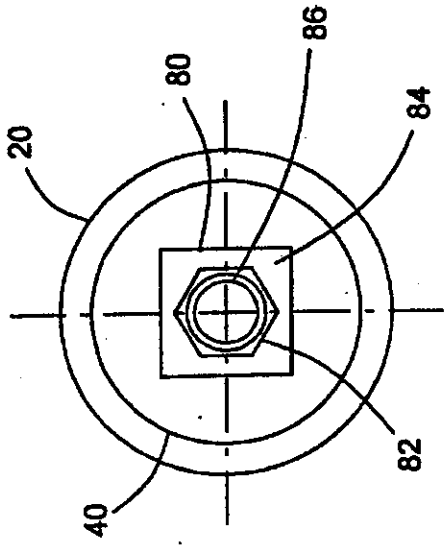
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Fig. 4

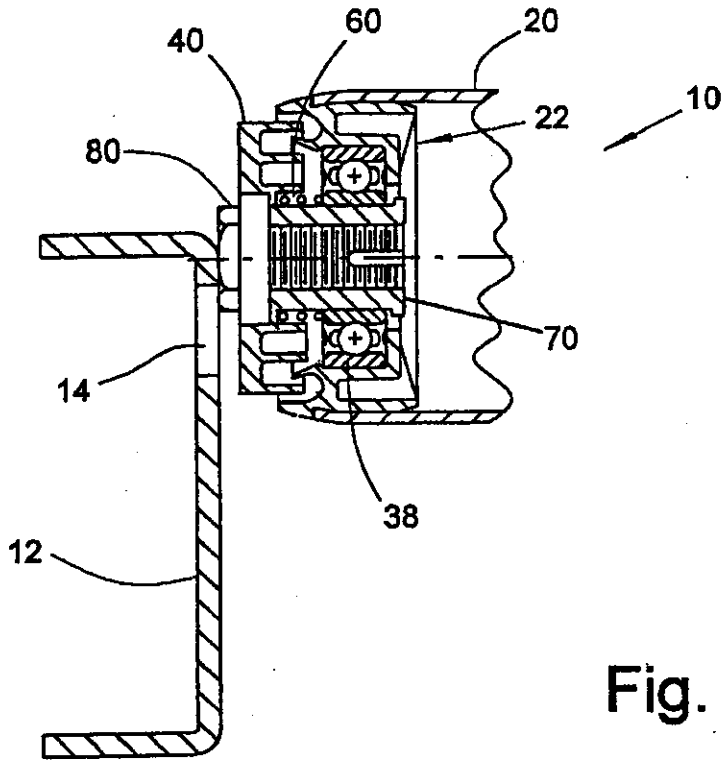

Fig. 6

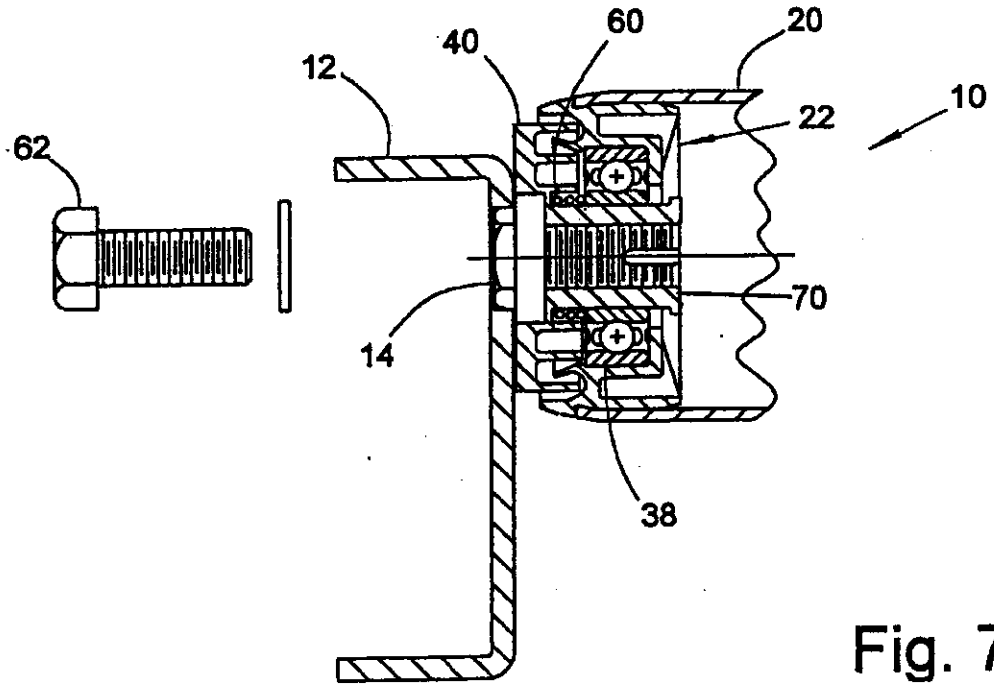

Fig. 7

STUB SHAFT CONVEYOR ROLLER

This application is a continuation of originally filed U.S. patent application Ser. No. 08/939,966 filed Sep. 29, 1997 and issued as U.S. Pat. No. 6,076,647.

FIELD OF THE INVENTION

The present invention relates generally to improvements in rollers for conveyors and, more particularly, to a conveyor roller of the type which is mounted on stub shafts.

BACKGROUND OF THE INVENTION

Roller conveyors are commonly used in many industries to move packages or materials. In general, a conveyor roller comprises a plurality of individual rollers mounted between two parallel frames. The roller typically comprises a tube having a bearing in each end thereof which is rotatably journaled on a roller shaft that extends longitudinally through the tube. The roller shaft protrudes from each end of the roller tube and engages mounting holes in the frame.

Frequently, the roller shaft not only serves to mount the roller, but also functions as a structural element of the conveyor frame. In such cases, the ends of the shaft are drilled and tapped. Bolts extending from the outside of the frame are threaded into the tapped holes in the roller shaft to secure the frame members and rollers together. This approach to the construction of conveyors makes assembly of the conveyor time consuming and difficult. Moreover, this method of constructing conveyors makes it difficult to replace a single roller.

Another method to mount rollers in a conveyor frame is to use a roller having a through-shaft which is spring-loaded. In this case, the frame members are held together independently by a series of cross members rather than through the rollers. The rollers generally are installed after the frame is assembled. To install the roller, the shaft is moved axially against the force of the spring and "snaps" into place when the shaft aligns with the mounting hole in the frame member. This method makes assembly of the conveyor much simpler and facilitates the replacement of rollers when they become worn or defective.

Several attempts have been made in the past to eliminate through-shafts in the roller. In place of a single thru-shaft, separate stub shafts have been used to support opposing ends of the conveyor roller. Typically, these stub shafts are bolted to the conveyor frame before the frame is assembled. The conveyor roller is then inserted over the stub shaft as the frame is locked together to create a final assembly. This method of mounting rollers in conveyors also makes assembly difficult. Moreover, this method essentially precludes prefabrication of the conveyor frame.

Accordingly, there is a need for a new method for mounting conveyor rollers in a frame which does not rely on a through-shaft extending through the roller, allows prefabrication of the conveyor frame, and facilitates ease of assembly.

SUMMARY AND OBJECTS OF THE IVENTION

The present invention combines the advantages of spring-loaded shafts, which make installation of the roller quick and easy, and a shaftless design which eliminates the need for a longitudinal through-shaft. To achieve these advantages, the present invention utilizes a sliding stub shaft which is spring-biased to an extended position. The stub shaft can be pushed inward against the force of the spring to allow

insertion of the roller into a prefabricated frame. When the stub shaft aligns with the mounting holes in the frame, the spring pushes the stub shaft outward to engage the mounting hole. One advantage of the present invention is that it enables quick and easy assembly of a conveyor. The conveyor frame can be prefabricated at the factory while the rollers are installed on site. Further, the present invention allows for easy replacement of a worn or defective roller without the need to disassemble an entire conveyor section.

The spring-biasing of the stub shaft also produces advantages not before realized in conveyors. The spring-biasing tends to center the roller after it is installed so that its rotating members do not rub against either frame member. The spring also allows shock absorption to take place when packages or other conveyed materials are moved laterally across the conveyor as they are loaded or unloaded. Furthermore, the constant preload on the springs eliminates vibration and noise which would resonate through the conveyor frame structure.

Yet another advantage of the present invention is its reduced weight. By eliminating a through-shaft that extends through the roller tube and replacing it with two smaller stub shafts, the total weight of the conveyor roller is reduced. Since conveyors use many individual rollers, the total weight reduction in a conveyor can be substantial. This weight reduction makes the conveyors more portable in the event that the conveyors need to be moved from one place to another. Also, shipping costs are reduced.

Yet another advantage which is beneficial in the food handling industry, is the ability to produce a relatively low cost, non-corrosive conveyor roller. In the food handling and chemical industries, conveyor rollers frequently employ stainless steel through-shafts. Sometimes, the additional cost of stainless steel makes the installation and use of conveyor systems impractical from a cost standpoint. By eliminating the through-shaft in its entirety, the stub shaft can be supplied with sophisticated corrosion resistant materials. Because the parts are so small, it does not negatively impact the overall cost of the system.

Another feature of the conveyor roller is increased safety. The retention of the roller in the frame is assured even in the event of bolt failure or vibration which could cause the bolt to fall out. In either instance, the spring-loading bias on the stub shaft acts as a reductive retention system to prevent the roller from falling out of the frame.

Other objects and advantages of the present invention will become apparent and obvious from a study of the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial cross section of the conveyor roller of the present invention showing the stub shaft in a normal extended position.

FIG. 2 is a cross section of the conveyor roller being inserted into a conveyor frame showing the stub shaft in a retracted position.

FIG. 3 is a cross section of the conveyor roller after its insertion into the frame showing the stub shaft in a partially extended position and engaged with the mounting holes in the frame member.

FIG. 4 is an end view of the second embodiment of the conveyor roller.

FIG. 5 is a partial cross section of the conveyor roller of the second embodiment showing the stub shaft in a normal extended position.

FIG. 6 is a cross section of the conveyor roller of the second embodiment being inserted into a conveyor frame showing the stub shaft in a retracted position.

FIG. 7 is a cross section of the conveyor roller of the second embodiment after its insertion into the frame showing the stub shaft in a partially extended position and engaged with the mounting holes in the frame member.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, and particularly to FIG. 1, the conveyor roller of the present invention is shown therein an indicated generally by the numeral 10. The roller 10 is adapted for use in conveyors, packaging machinery, linear motion material handling devices, and treadmills, but may also have other applications. The roller 10 is mounted between parallel frame members 12 which support the roller 10 at opposite ends thereof. The frame members 12 form part of a conveyor frame and may be held together, for example, by cross members (not shown). Each frame member 12 has a series of mounting holes 14 formed therein for mounting the roller 10. The present invention is particularly related to an improved mounting system for mounting the roller 10 in the conveyor frame.

The roller 10 comprises a generally cylindrical roller tube 20 which is rotatably journaled on a pair of stub shafts 50. A bearing housing 22 is inserted into each end of the roller tube 20 and houses a bearing 38 in which the stub shaft 50 isjournaled. The bearing 38 is retained by friction in the bearing housing 22. A bearing shield 40 fits on the outer end of the stub shaft 50. The stub shaft 50 and bearing shield 40 are biased by a spring 60 to an extended position as shown in FIG. 1. The stub shaft 50 can be moved to a retracted position by applying a force to the end of the stub shaft 50. With the stub shaft 50 in a retracted position, it is easy to insert the roller 10 into an already assembled conveyor frame.

The bearing housing 22 is typically molded from a plastic material. The bearing housing 22 includes an outer cylindrical wall 24 and an inner cylindrical wall 26 which define an annular cavity 28 therebetween. The outer wall 24 is sized to provide an interference fit with the roller tube 20. The inner wall 26 frictionally engages and holds the roller bearing 38. The roller bearing 38 is pressed into the bearing housing 22 until it engages the back wall 30. Back wall 30 of the bearing housing 22 includes a center opening 31 through which the stub shaft 50 extends.

The outer end 32 of the bearing housing 22 includes a seal cavity 34 which, in conjunction with the bearing shield 40, provides a labyrinth seal to prevent dirt and other contaminants from reaching the bearing 38. A lip 36 is also formed at the outer end 32 of the end cap 22 which butts against the end of the roller tube 20, which is bent inward slightly to help hold the bearing housing 22 in place. The inner end of the outer wall 24 is slightly tapered to facilitate insertion of the end cap 22 into the roller tube 20.

As previously mentioned, the bearing housing 22 houses a bearing 38. The bearing 38 may preferably be a radial ball type bearing as shown in FIG. 1. However, it should be understood that the present invention will work equally well with molded plastic or bronze bushing designs. The function of the bearing 38 is to reduce friction as the roller tube 20 rotates about the stub shaft 50.

The stub shaft 50 includes an inner portion 52 and an outer portion 54. The inner portion 52 has a cylindrical configuration and is journaled in the bearing 38. It should be noted, however, that the inner portion 52 of the stub shaft 50 and the inner race of the bearing 34 could have a polygonal configuration without departing from the spirit of the present invention. The outer portion 54 of the stub shaft 50 preferably has a hexagonal configuration and is adapted to mate with a similarly shaped and sized opening 14 in the mounting frame 12.

A small flange 56 is formed at the inner end of the stub shaft 50. The purpose of the flange 56 is to act as a stop when the stub shaft 50 reaches an extended position. The flange 56 is designed to butt against the bearing 38 to prevent the further extension of the stub shaft 50.

A threaded hole 58 is located through the center of the stub shaft formed at the end of the outer portion 54. The threaded hole 58 is adapted to receive a bolt 62 which extends from the outside of the frame 12 into the threaded hole 58. The purpose of the bolt 62 is to secure the roller 10 in place after it has been inserted into the frame 12.

The bearing shield 40 is press fit onto the outer portion 54 of the stub shaft 50. The bearing shield 40 includes a hub 42 and a cover portion 44. The hub 42 includes a hexagonal bore 45 which is sized to provide a tight, frictional fit with the outer portion 54 of the stub shaft 50. The cover portion 44 extends radially outward from the hub 42 to provide a cover for the bearing 34. Two cylindrical walls 46 and 48 project inwardly from the back side of the cover portion 44. The outer wall 46 is disposed at the periphery of the cover portion 44. The inner wall 46 is spaced slightly inward from the outer wall 44 and is concentric with the outer wall 46. The walls 46 and 48, along with the previously mentioned seal cavity 34, forms a labyrinth seal.

The spring 60 is disposed around the hub 42 of the bearing shield 40. One end of the spring 60 presses against the bearing 38 while the opposite end presses against the bearing shield 40. Thus, the spring 36 biases the stub shaft 50 to an extended position.

To install the roller 10 between parallel fame members 12, the roller 10 is held in a tilted position while the stub shaft 50 at one end is inserted into its mating mounting hole 14. After the first end of the roller is inserted into the mounting hole 14, the stub shaft 50 on the opposing end is pressed inward to move the stub shaft 50 to a retracted position (see FIG. 2). The second end is then lowered between the frame members 12 until the stub shaft 50 is aligned with its mating mounting hole 14 in the frame member 12. When the stub shaft 50 is aligned with the mounting hole 14, the spring 36 urges the stub shaft 50 to an extended position so that it engages the mounting hole 14 (see FIG. 3). The bolt 62 is then inserted through the mounting hole 14 in the frame member 12 and threaded into the threaded hole 58 in the stub shaft 50 to secure the roller 10 in place.

FIGS. 4–6 illustrate an alternate embodiment of the roller 10. This embodiment uses the same roller 10 and bearing housing 22 as previously described. The description of these elements, therefore, will not be repeated. However, it should be noted that the reference numbers in FIGS. 4–6 which are the same as the reference numbers in FIGS. 1–3 indicate the same parts.

The second embodiment, shown in FIGS. 4–6, eliminates the stub shaft 50. Instead, a bearing shaft 70 is integrally formed with the bearing shield 40. The bearing shaft 70 isjournalled in the bearing 38. The bearing shaft 70 is hollow and internally threaded. The inner end 72 of the bearing shaft is designed to retain the bearing shaft 70 in place. Two diametrically opposed relief slots 74 are formed in the inner end 72 of the bearing shaft 70. The purpose of the relief slots

74 is to facilitate insertion of the bearing shaft 70 through the bearing 38. When the bearing shaft 70 is pressed into the bearing 38, the inner end 72 collapses inwardly to allow the bearing shaft 70 to pass through the bearing 38. When the bearing shaft 70 passes through the bearing 38, the inner end 72 expands back to its original form due to the inherent resiliency of the material.

An insert 80 is adapted to fit into a recess formed in the outer surface of the bearing shield 40. The insert 80 includes a hexagonal stub member 82 and a base portion 84. The hexagonal stub member 82 mates with the hole 14 in the frame member 12. The base portion 84 of the insert 80 fits into a recess or socket formed in the outer surface of the bearing shield 40. The base 84 of the insert 80 and the recess both have a square configuration to prevent rotation of the insert 80 relative to the bearing shield 40.

A hole 86 extends through the insert 80. The bolt 62, which secures the roller 10 to the frame member 12, passes through the insert 80 and engages the threads on the inner surface of the bearing shaft 70. Consequently, the insert 80 gets captured between the bearing shield 40 and the frame member 12 so that it cannot be dislodged.

One advantage of using insert 80 is that it can be easily interchanged in the field. For example, if the frame member 12 has square mounting holes 14 rather than hexagonal mounting holes 14, an insert 80 with a square stub 82 can be inserted into the shield 40. Without the replaceable insert 80, it would be considerably more difficult to modify the roller to fit a square mounting hole 14.

Based on the foregoing, it will be apparent that the conveyor roller 10 of the present invention can be easily installed and removed from a pre-fabricated conveyor frame. Moreover, the present invention employs a "shaftless" design which substantially reduces the weight of the roller.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. A roller insert for a conveyor roller tube, said roller insert comprising:

a) a generally cylindrical housing;

b) a bearing mounted within said cylindrical housing, said bearing having an inner race and an outer race;

c) a stub shaft positioned within said bearing and movable between extended and retracted positions, said stub shaft having a stop to limit the positioning of said stub shaft in said extended position, said stop contacting said inner race of said bearing;

d) a bearing shield disposed around said stub shaft; and

e) a biasing device to bias said stub shaft to said extended position.

2. The insert of claim 1, wherein said stub shaft has a hexagonal outer shape.

3. The insert of claim 1, wherein said bearing housing includes an inner cylindrical wall frictionally engaging said bearing, and an outer cylindrical wall engaging the roller tube.

4. The insert of claim 1, wherein said cylindrical housing is rotatable relative to said stub shaft.

5. The insert of claim 1, further including a lip extending outward from said cylindrical housing for positioning the roller insert within the roller tube.

6. The insert of claim 1, wherein said biasing device is positioned between said bearing and said bearing shield.

7. A roller insert for a roller tube comprising:

a) a housing having a substantially cylindrical outer wall and an inner wall;

b) a bearing positioned against said inner wall of said housing said bearing having an inner race and an outer race;

c) a stub shaft positioned within said bearing and being movable between extended and retracted positions;

d) a biasing device positioned about said stub shaft to bias said shaft towards said extended position; and

e) a stop to limit the axial movement of said stub shaft in said extended position said stop contacting said inner race of said bearing.

8. The insert of claim 7, wherein said stub shaft extends outward from a first end of said housing in said extended position.

9. The insert of claim 8, wherein said stub shaft first end is substantially aligned with said first end of said housing in said retracted position.

10. The insert of claim 7, further including a bearing shield substantially positioned along a first end of said housing, said bearing shield having an aperture through which said stub shaft extends.

11. The insert of claim 10, wherein said stop contacts said bearing to limit movement of said stub shaft in said extended position.

* * * * *

CERTIFICATE OF SERVICE

I hereby certify that one copy of the foregoing **AMENDED COMPLAINT** is being forwarded by first class mail, postage prepaid and addressed to:

Dickson M. Lupo
Richard M. McDermott
Alston & Bird, LLP
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Charlotte, North Carolina 28234

This the 5th day of April 2001.

Anthony J. Biller
Attorney for the Plaintiff