Sept. 17, 1963 G. W. KARR 3,104,074

PNEUMATIC CORE SHAFT

Filed Feb. 27, 1961 2 Sheets-Sheet 1

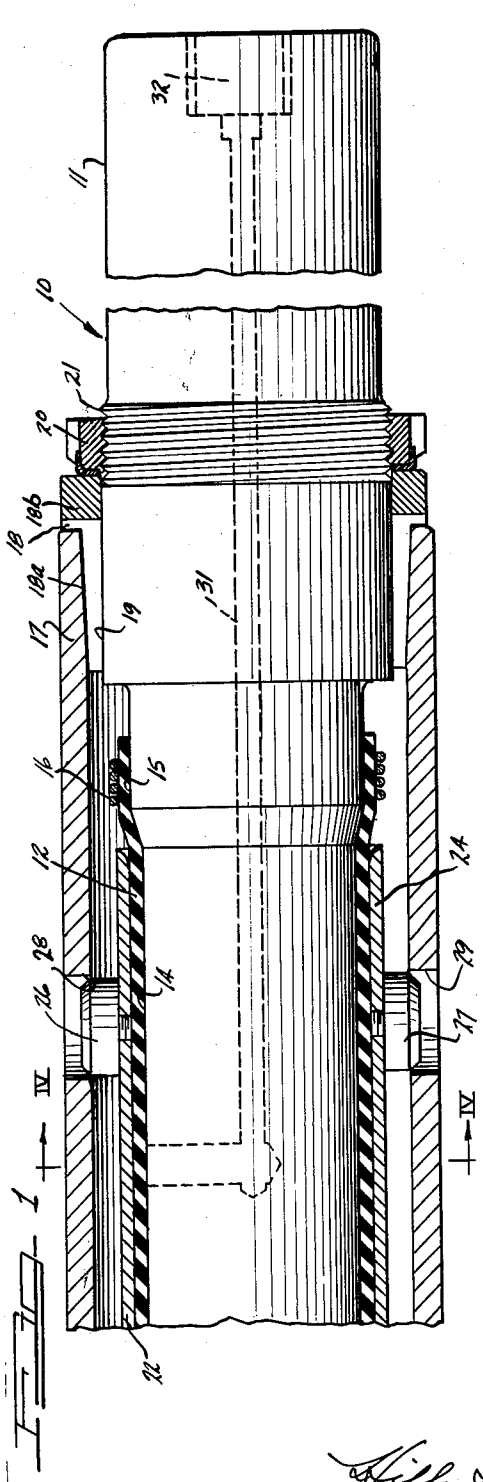


Fig. 1

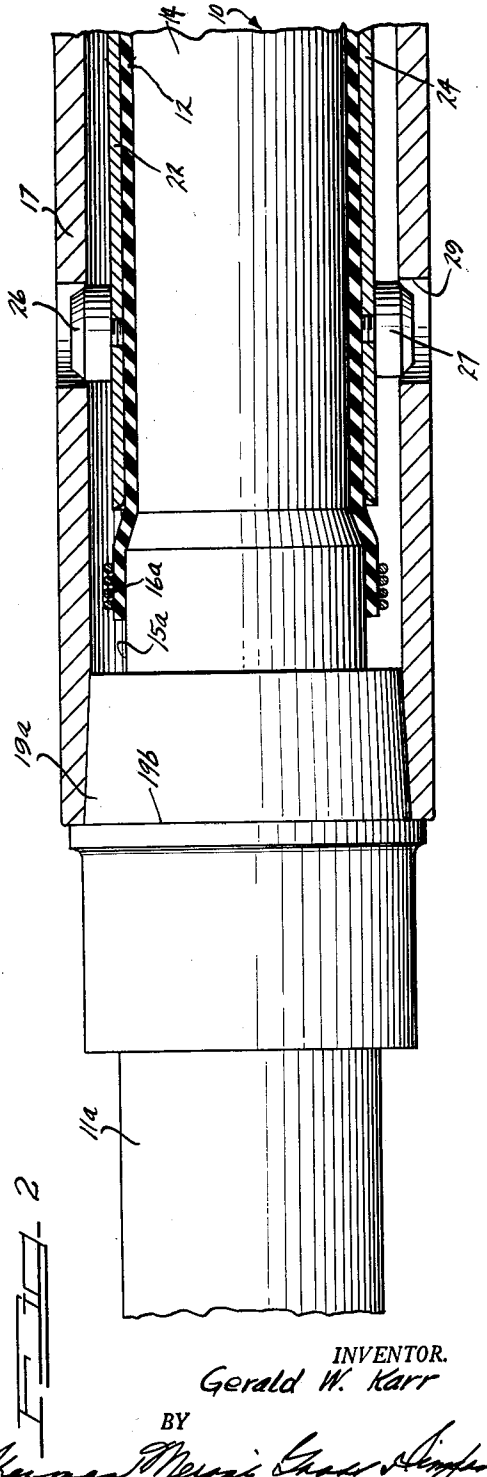


Fig. 2

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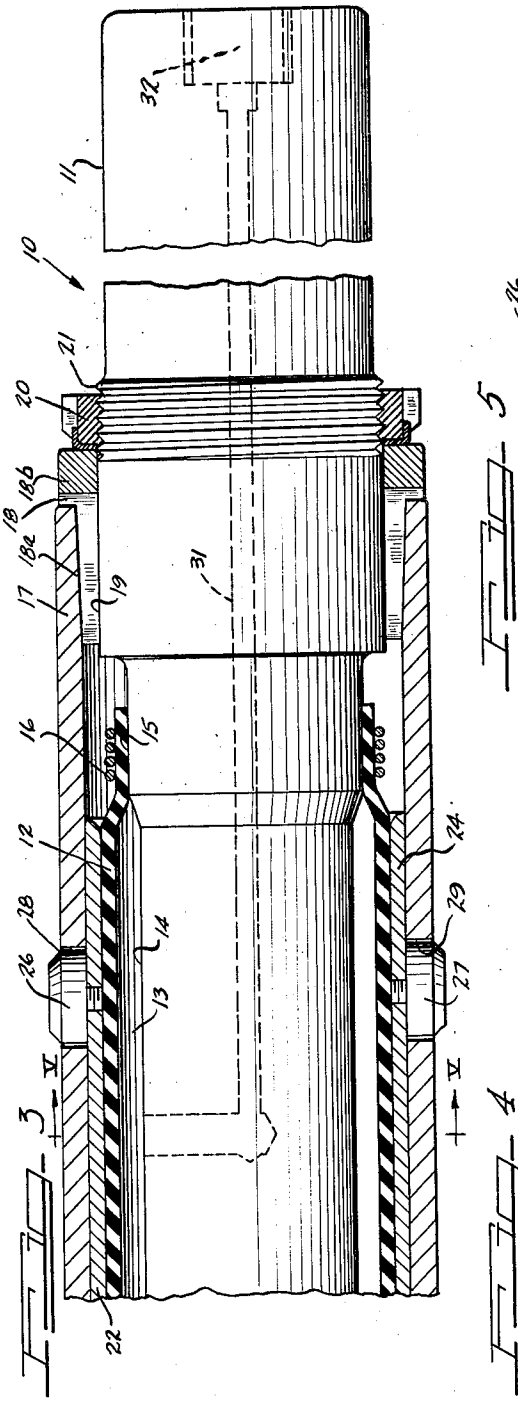


FIG. 3

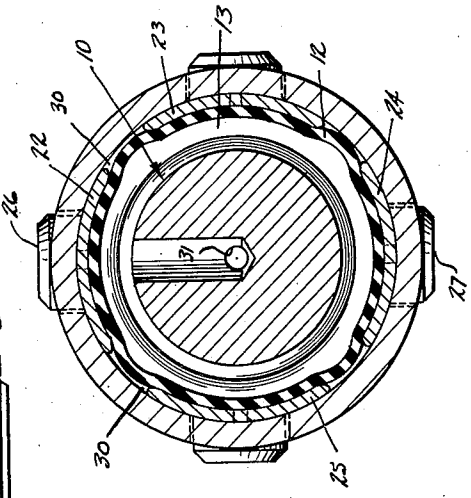


FIG. 5

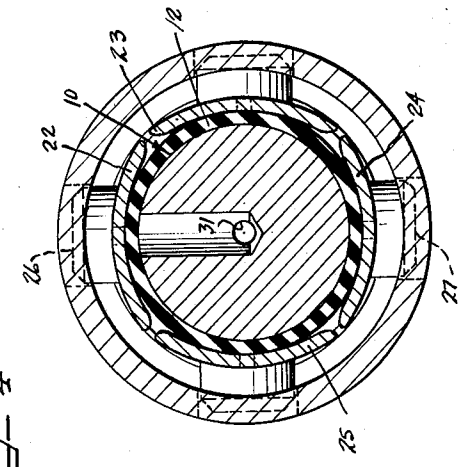


FIG. 4

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PNEUMATIC CORE SHAFT

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2 Claims. (Cl. 242—72)

The present invention relates to improvements in expandible and contractible shafts and particularly to shaft assemblies for supporting and gripping the internal surface of a hollow core such as used in winding and unwinding rolls of paper.

In winding and unwinding rolls of sheet material such as paper, individual small rolls may be wound from a large parent roll with the material of the parent roll often being slit into narrower sheets. The paper is wound on hollow tubular cores from rolls on hollow cores both of which are rotated at relatively high speed and which are supported by central shaft assemblies that are expanded against the inner surface for concentrically supporting the rolls. The shaft assemblies are frequently driven in rotation or braked through the shaft or by external contact with the roll to control the speed of rotation of the rolls as is known in winding and unwinding operations, and the shaft assemblies must provide good reliable driving supports in view of the weights of the rolls and the forces which must be applied thereto.

An object of the invention is to provide an improved pneumatically expanded core shaft assembly of improved construction obtaining more reliable, more effective core support.

A further object of the invention is to provide a core support assembly which employs a full length one-piece center shaft and is of improved construction utilizing a simplified pneumatic tube and an air chamber having a low volume capacity.

A still further object of the invention is to provide an improved core supporting shaft assembly well suited for use in winders, having a simplified improved more rigid construction and providing improved features for changing the tubular elastomeric expansion tube.

A still further object of the invention is to provide a winding core support shaft assembly which does not require removal of portions of a center shaft for replacement of the pneumatic tube, and wherein parts are maintained in firm assembly during rotation preventing out of balance conditions.

A further object of the invention is to provide an improved more rigid more stable core supporting shaft assembly which provides a continuous rigid beam support through the center of the core assembly and which supports a core with reliable accurate concentricity and is capable of supporting substantial weights and sustaining external radial pressures against the core without losing the concentricity.

Other objects and advantages will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiment thereof in the specification, claims and drawings, in which:

FIGURES 1 and 2 are fragmenary elevational views of opposite ends of a core shaft assembly constructed in accordance with the principles of the present invention showing the parts in position for sliding a core on or off the shaft;

FIGURE 3 is a fragmentary elevational view similar to FIGURE 1 but showing the parts in position for gripping a core on the shaft;

FIGURE 4 is a vertical sectional view taken substantially along line IV—IV of FIGURE 1; and

FIGURE 5 is a vertical sectional view taken substantially along line V—V of FIGURE 3.

As shown on the drawings:

Extending through the center of the core-supporting shaft assembly shown in the drawings is a continuous one-piece rigid center shaft **10**, that acts as a full length beam, having journal ends **11** and **11***a* for rotatably mounting the shaft assembly. The ends will usually be releasably held in supporting bearings for removal for slipping a fresh core over the shaft assembly or for the removal of a core therefrom.

Cores are supported on the assembly for rotation therewith by a mechanism which expands radially, shown in the form of an elongated elastomeric tube **12**. The shaft extends concentrically through the center of the tube and a small annular air chamber **13** is formed between the tube and shaft. The shaft is slightly reduced at its central portion **14** so as to provide shoulders **15** and **15***a* which support the ends of the tube. The ends are suitably bonded to the shoulders **15** and **15***a* such as by annular bindings **16** and **16***a* that clamp the tube ends radially to the shoulders **15** and **15***a*. Annular sloping surfaces extend between the shoulders **15** and **15***a* and the central portion **14**. When the tube **12** is collapsed it rests on these sloping surfaces and on the central portion **14**.

Supported concentric with the shaft **10** is an outer tubular shell **17**. The shell is supported at one end, as shown in FIGURE 1, by an annular collet **18**, which may be in arcuate segments or in the form of a split ring, having a tapered outwardly facing annular surface **18***a* which engages the inner surface of the end of the outer shell **17**. The collet **18** is supported on the shaft surface **19** and is held axially against the end of the outer shell **17** by a rigid ring **18***b* and threaded nut **20** turned onto threads **21** on the shaft **10**. Thus the collet **18** and the ring **18***b* and nut **20** provide radial and axial support for the outer shell at one end. At the other end, as shown in FIGURE 2, the shell **17** slides over a tapered surface **19***a* which supports it radially and the end abuts a radial face **19***b* which provides axial support. When the nut **20** of FIGURE 1 is tightened, the tube is rigidly clamped in an axial direction between the collet **18** and the radial face **19***b*. Both ends of the shell **17** are rigidly held in a radial and axial direction by the continuous one-piece shaft **10** which provides a rigid beam for carrying the core and its contents.

For frictionally engaging the inner surface of the core and holding it on the outer shell so that it will rotate therewith and remain in a fixed axial position thereon, individual expander plates **22**, **23**, **24** and **25** are positioned circumferentially around the tube **12** within the outer shell **17**. The expander plates preferably extend the full length of the tube and are substantially the length of the air chamber **13** which is between the tube **12** and the portion **14** of the shaft, FIGURES 3 and 5.

Spaced axially along each of the expander plates **22** are friction buttons, such as shown at **26** for the expander plate **22** and at **27** for the expander plate **24**. The friction buttons **26** and **27** extend through openings **28** and **29** through the outer shell **17**. These openings are provided for each of the buttons and are positioned at axially and circumferentially spaced locations around the outer shell **17**. Thus the expander plates and friction buttons provide friction members operated by the tube to move radially outwardly for engaging the inner surface of the core when the tube is inflated. The expander plates are shown in their expanded position in FIGURES 3 and 5 with the tube **12** inflated in spaces **30** between the plates. The expander plates and tube **12** are shown in their retracted positions when air is permitted to escape from the air chamber **13**, in FIGURES 1, 2 and 4. An air inflation

passage **31** extends axially from one end through the shaft **10** and opens radially into the air chamber **13**. At one end of the shaft **10** is positioned a threaded recess **32** for attaching an air valve for controlling the inflation of the tube **12**.

In brief summary of operation, air is exhausted from the air chamber **13** so that the expander plates are retracted radially inwardly as shown by the plates **22** and **24** in FIGURES 1, 2 and 4 and the plates tend to release the buttons simultaneously and also aid in making the pressure uniform between each of the buttons and the core interior surface. A core is slide over the outer shell **17**, and when it is axially located, the air chamber **13** is pressurized through the passageway **31**. This moves the expander plates radially outwardly, FIGURES 3 and 5, projecting the buttons out through the openings in the shell to held the core in its centered position on the outer shell **17**.

Thus it will be seen that I have provided an improved core supporting shaft assembly which meets the objectives and advantages above set forth. The mechanism provides a support with a rigid beam-like continuous shaft center which does not have to be disassembled for attaching the core or for replacing the tube **12**. The parts are accurately centered on the shaft **10** for holding the outer shell **17** concentric and for supporting the core and driving a core in rotation at the speed of rotation of the shaft assembly. A small air chamber **13** is provided that requires a minimum of time to inflate and deflate which becomes important on long shafts or large diameter shafts and inflation pressures can be used in accordance with the frictional contact necessary with a core.

The mechanism is simple in construction and easy to assemble and disassemble and the parts can be reassembled with accuracy after replacement of the expandible tube. All parts are rigidly positioned and supported on the strong center shaft **10**.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

1. A core supporting assembly for winders comprising a continuous one-piece center shaft having journal ends and having a center portion of reduced diameter defining annular shoulders spaced axially inwardly from the ends and outwardly of said center portion, an elastomeric tube coaxially positioned over said center shaft, clamping means holding the ends of the tube against the annular shoulders to form an annular air chamber between the center portion of the shaft and the tube, annular sloping surfaces extending between each of the shoulders and said center portion and coacting with said center portion to form a seat for the tube when it is collapsed radially inwardly,

means defining an inflation passage extending axially from one end of the center shaft and opening into said air chamber, an outer tubular shell concentrically mounted at its ends on the center shaft and having axially and circumferentially spaced radial openings therein, individual expander plates extending axially and located between the tube and outer shell for substantially the length of the air chamber providing circumferential spaces between the plates when forced outwardly against the inner surface of the outer shell, and outwardly projecting friction buttons on each of the expander plates aligned with the openings in the outer shell for frictionally engaging the inner surfaces of a core on the assembly.

2. A core supporting assembly for winders comprising a continuous one-piece center shaft having journal ends and having a center portion of reduced diameter to define annular shoulders spaced axially inwardly from the ends, an elastomeric tube coaxially positioned over said center shaft, clamping means holding the ends of the tube against the annular shoulders to form an annular air chamber between the center shaft and tube, means defining an inflation passage extending axially from one end of the center shaft and opening into said air chamber, an outer rigid metal tubular shell concentrically mounted at its ends on the center shaft and having axially and circumferentially spaced radial openings therein, an annular collet mounted on the shaft and supporting one end of the outer shell and having a radial shoulder rigidly engaged by the end of the shell, an end nut threaded axially on the center shaft against the collet, means for supporting the other end of the shell having a radial shoulder rigidly engaged by the other end of the shell, individual expander plates extending axially between the tube and outer shell for substantially the length of the air chamber providing axial spaces between the plates when forced outwardly against the inner surface of the outer shell, and outwardly projecting friction buttons on each of the expander plates aligned with the openings in the outer shell for frictionally engaging the inner surfaces of a core on the assembly.

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