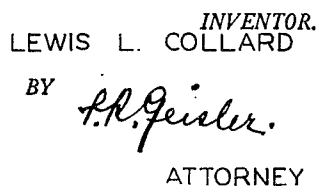


Filed Jan. 30, 1948

EXPANSIBLE SHAFT

2 Sheets-Sheet 1



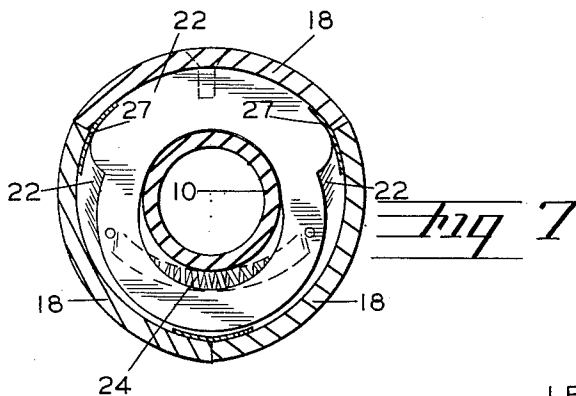
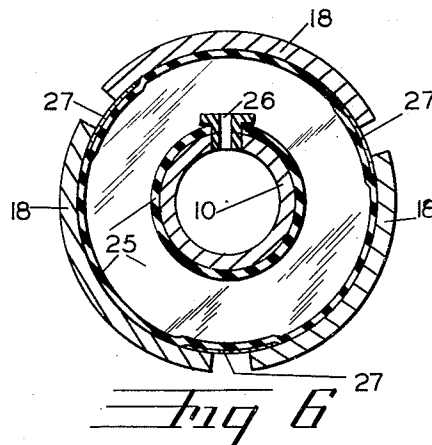
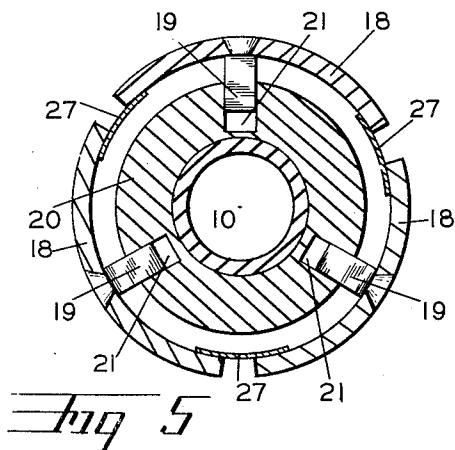
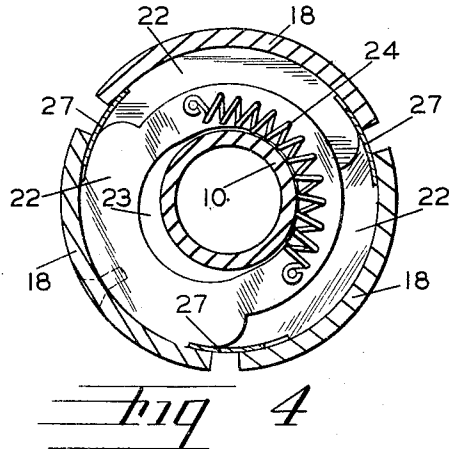
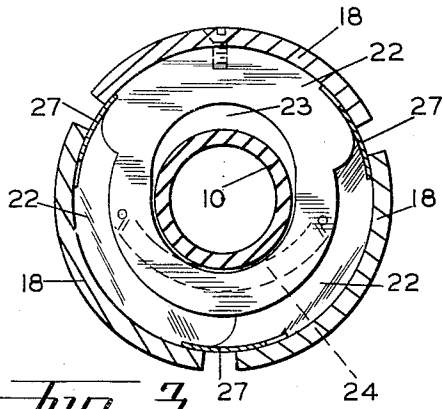
Aug. 29, 1950

L. L. COLLARD
EXPANSIBLE SHAFT

2,520,126

Filed Jan. 30, 1948

2 Sheets-Sheet 2



INVENTOR.
LEWIS L. COLLARD

BY *H.R. Feister.*

ATTORNEY

UNITED STATES PATENT OFFICE

2,520,126

EXPANSIBLE SHAFT

Lewis L. Collard, Camas, Wash., assignor to
Crown Zellerbach Corporation, San Francisco,
Calif., a corporation of Nevada

Application January 30, 1948, Serial No. 5,381

8 Claims. (Cl. 242-72)

1

This invention relates in general to winder shafts and cores, and, in particular, to shafts on which webs of sheet material such as paper may be wound.

More specifically, this invention relates to expandible winder shafts for rolls of paper.

It has been customary in the past to use comparatively heavy cardboard tubes as cores for the winding of rolls of paper, the tubes or cores being mounted on expanding chucks or shafts during the winding operation, and the cardboard core then becoming a permanent part of the finished roll of paper. More recently it has been found that such inner cores or tubes of cardboard are generally unnecessary if the paper is wound tightly on a metal shaft or core, provided such metal shaft or core is so constructed that it can be withdrawn from the roll, in as much as the center of a tightly wound roll of moderately heavy paper will retain its shape and position for the roll without requiring any core to be kept therein. Accordingly, a number of paper mills are now following the practice of winding paper directly on expanded shafts or cores of different types and then subsequently removing such shaft or core from the roll after the winding has been completed. The dispensing with the cardboard core or tube for paper rolls results in considerable saving, as apparent.

The object of the present invention in general, is to provide an improved expandible shaft adapted particularly for having a roll of paper wound directly thereon.

A further object of this invention is to provide an expandible shaft which will have an expandible outer shell formed of metal sections which are so arranged and mounted that the effective outside circumference of the shell can be quickly and easily expanded in preparation for the winding of the paper on the same and can be quickly and easily contracted and withdrawn from the roll when the winding is completed.

A still further object of this invention is to provide an improved expandible shaft of the type above indicated in which the expansion or contraction of the outer surface or shell sections of the shaft will be controlled by pneumatic pressure.

While the idea of pneumatic expandible shafts for paper rolls is not new, heretofore with shafts of this type the expandible rubber tubes or rings have been so mounted as to have direct contact with the inside of the paper roll or core. This causes wear on the outer surfaces of the rubber elements and increases the likelihood of blowouts

2

occurring. An additional object of this invention is to provide a pneumatically expandible shaft in which the rubber tubes or rings will be entirely protected by metal elements so as to avoid any direct contact between the rubber tubes or rings and the paper.

These objects and other advantages I attain by constructing my improved expandible shaft substantially as illustrated in the accompanying drawings and as hereinafter briefly described with reference to the drawings.

In the drawings:

Fig. 1 is an elevation of the entire expandible shaft, showing the same in expanded position, but with the roll of paper omitted therefrom for the sake of clarity;

Fig. 2 is a vertical longitudinal section of the expanded shaft drawn to a larger scale with the paper roll supported thereon indicated by broken lines;

Figs. 3, 4, 5 and 6 are transverse sections of the shaft taken on the vertical planes indicated by the lines 3-3, 4-4, 5-5 and 6-6 respectively of Figure 2, but drawn to a still larger scale, all these figures showing the shaft in expanded position; and

Fig. 7 is a section on the same vertical plane as Fig. 4 but showing the shaft contracted.

Referring first to Figure 2, the main body portion of the shaft consists of an inner metal tube 10 which extends the full length of the shaft. One end of the tube 10 is sealed, for example, by means of a plug as indicated at 11. An air inlet valve 12, of the type used for automobile tires, is mounted in the other end of the tube 10 and is adapted to be connected by means of the usual air hose (not shown) to a source of air under pressure.

On the same end of the tube 10 as the air inlet valve 12, there is mounted an air release valve consisting of a valve core 13, having an inwardly extending channel 14 adapted to register with a perforation in the wall of the metal tube 10, and an air release valve handle or sleeve 15, rotatably mounted on the core 13 and so arranged that the air exhaust channel 14 can be opened or closed by a slight turn of the handle or sleeve 15.

A journal 16 is firmly secured on the outside of the tube 10 adjacent the release valve core 13, and another journal 17 is secured on the opposite end of the tube 10.

The outer surface of my expandible shaft is composed of three longitudinally-extending cylindrical surface segments 18. (See also Figs. 3,

4 and 5.) Each of these segments 18 carries a plurality of rigidly-mounted pins 19 extending radially inwardly from the inside surface of the segment, as shown in Figs. 2 and 5. At spaced intervals along the tube 10 positioning collars 20 are fixedly secured and these positioning collars are provided with radially-extending recesses 21 which slidably accommodate the pins 19. Thus the cylindrical surface segments 18 may move radially outwardly from the perimeters of the positioning collars 20 and in this manner may move outwardly or inwardly with respect to the tube 10, but are held against any longitudinal movement by the sliding pins 19 within the recesses 21.

Each of these surface segments 18 is also secured at its inside surface to a plurality of retaining rings 22. The shape of these retaining rings is shown in Figs. 3 and 4. Each retaining ring has an elongated center opening 23, the minor dimension of which is slightly greater than the outside diameter of the metal tube 10 and the major dimension of which is considerably greater. Approximately two-thirds of the rim of each retaining ring is of reduced width, as shown in Figs. 3 and 4, the width of the remaining portion being approximately the same as the radial width of the positioning collars 20. Each retaining ring is provided with spring means, such as the coil spring 24 (Fig. 4), which is so arranged as to tend to pull the wider rim portion of the retaining ring 22 (and therewith the surface segment 18 which is attached to the retaining ring at the wider rim portion) inwardly as far as permitted by the center opening 23.

A plurality of inflatable rubber tubes or rings 25 are mounted around the metal tube 10 at spaced intervals. Each of these inflatable rubber rings 25 is connected to the inner metal tube 10 by an air channel nipple assembly 26 (Fig. 6), so arranged as to permit air to pass freely from the interior of the tube 10 into the rubber rings 22, or to permit the air to pass in the reverse direction from the rubber rings into the tube 10, depending upon the air pressure in the tube 10.

Thus, when air is forced into the tube 10, the rubber rings 25 will be inflated, and by pressing against the interior of the surface segments 18, will force the latter to move to their outer expanded position; and when the air pressure within the tube 10 is relieved, reducing the inflation of the rubber rings 25, the springs 24 on the retaining rings 22 will cause the surface segments 18 to be pulled in to their inward or retracted position.

Along one edge on the interior face of each surface segment 18 a thin flexible metal slide 27 is secured which slidably engages the inner face of the next adjacent segment 18 along its edge and thus bridges the longitudinal gap between the edges of the two surface segments when the surface segments are in expanded position. The purpose of these thin metal slides 27 is to provide protective covers for the rubber rings 25 in the gaps between the edges in the surface segments 18 and thus to protect the rubber rings and prevent any possibility of blowouts occurring in these gaps when the inflation of the rubber rings has forced the surface segments 18 into expanded position. Similarly, to prevent blowouts occurring at the ends of the rubber rings 25 inside the surface segments when the shaft is in expanded position, I provide an additional series of three thin protective metal rings or shims 28 (Fig. 2), at each end of each rubber ring. These protective

end rings or shims 28 are exactly the same shape and size as the retaining rings 22 previously described, and each protective end ring is attached to one of the surface segments 18. Springs are omitted from these end protective rings in order that the three rings of each set can be pressed close together, slidably bearing on each other, and thus collectively forming an effective adjustable thin metal wall at each end of the rubber rings. These sets of protective rings 28 are placed between the positioning collars 20 and the corresponding ends of the rubber inflatable rings.

The entire expansible shaft is supported for rotation in any suitable manner. For example, the shaft may be supported on a pair of pedestals 29 and 30, one at each end of the shaft, as illustrated in Figs. 1 and 2. These pedestals have suitable bearings 31 in which the journals 16 and 17 rest. Preferably, a hinged cap 32, having a bearing 33 on its inner side, extends over the upper half of the journal 16 and is hinged secured on the pedestal 29 so as to hold the shaft in place on the pedestal and prevent any longitudinal movement of the shaft when the shaft is mounted for rotation. Any suitable means for rotating the shaft when the shaft is positioned on the pedestals 29 and 30 may be employed as desired, such means not being shown in the drawings, in as much as the same does not form any part of this invention.

The manner of operating my expansible shaft is as follows: The valve 12 is connected to a source of compressed air (the exhaust valve control 15 being closed), and the rubber rings 25 are inflated until the surface segments 18 are firmly held in their expanded position. The inflating of the shaft may be done either when the shaft is in rotatable position on the supporting pedestals 29 and 30, or may be done before the shaft is mounted thereon, whichever is more convenient. The hose or other means by which air under pressure is delivered to the shaft is then disconnected from the shaft and the shaft is then ready to have the paper wound on it. The shaft remains in its expanded position until the winding of the paper upon it has been completed. The outer end of the wound paper is then fastened down on the roll, the shaft and roll are then lifted from the supporting standards, and the roll with the shaft still secured therein is set on a table for the removal of the shaft. When the shaft is to be removed from the roll, the operator turns the exhaust valve control 15 so as to open the exhaust valve and produce deflation of the shaft. This immediately results in causing the surface segments 18 to be returned to their retracted position, whereupon the shaft is easily slid out from the center of the paper roll. The shaft is now ready to be inflated again and used for the winding of the second roll.

I claim:

1. In an expansible shaft of the character described, an inner metal tube, an air valve connected with said tube, means for preventing escape of air from said tube, a plurality of longitudinally-extending cylindrical surface segments on the outside of said tube and spaced from said tube, a plurality of pins extending radially inwardly from the inside face of each of said surface segments, positioning collars secured on said tube, radially-extending recesses in said collars for slidably accommodating said pins, means limiting the radial movement of said surface segments with respect to said tube, a plu-

5

ality of inflatable resilient rings axially spaced about said tube inside said surface segments, a channel connecting each of said inflatable rings with the interior of said tube, and means mounted on longitudinal edges of said surface segments so arranged as to extend over the gaps between said surface segments when said surface segments are in expanded position to prevent blowouts occurring in said inflatable rings at such gaps.

2. In an expansible shaft of the character described, an inner metal tube, an air inlet valve located at one end of said tube, a sealing plug at the other end of said tube, three longitudinally-extending cylindrical surface segments on the outside of said tube and spaced from said tube, a plurality of rigidly-mounted pins extending radially inwardly from the inside face of each of said surface segments, positioning collars secured on said tube, radially-extending recesses in said collars for slidably accommodating said pins, retaining rings on said tube, each of said retaining rings having an elongated center opening permitting movement of the retaining ring in a direction perpendicular to the axis of said tube, each surface segment secured to a plurality of said retaining rings, a plurality of inflatable rubber rings axially spaced about said tube inside said surface segments, a channel connecting each of said inflatable rings with the interior of said tube, and slides mounted on longitudinal edges of said surface segments so arranged as to extend over the gaps between said surface segments when said surface segments are in expanded position to prevent blowouts occurring in said inflatable rings at such gaps.

3. In an expansible shaft of the character described, an inner metal tube extending the full length of the shaft, an air inlet valve located at one end of said tube, a sealing plug at the other end of said tube, an air exhaust valve carried by said tube, three longitudinally-extending cylindrical surface segments on the outside of said tube and spaced from said tube, a plurality of rigidly-mounted pins extending radially inwardly from the inside face of each of said surface segments, positioning collars secured on said tube, radially-extending recesses in said collars for slidably accommodating said pins, retaining rings on said tube, each of said retaining rings having an elongated center opening permitting movement of the retaining ring in a direction perpendicular to the axis of said tube, each surface segment secured to a plurality of said retaining rings, said pins, collars, recesses and rings combining to permit restricted radial movement of said surface segments with respect to said tube, springs associated with said retaining rings exerting a force to pull said surface segments inwardly as far as permitted by said center openings, a plurality of inflatable rubber rings axially spaced about said tube inside said surface segments, a channel connecting each of said inflatable rings with the interior of said tube, slides mounted on longitudinal edges of said surface segments so arranged as to extend over the gaps between said surface segments when said surface segments are in expanded position to prevent blowouts occurring in said inflatable rings at such gaps, and means at the ends of said inflatable rings to guard against blowouts at said ends of said inflatable rings.

4. An expansible winder shaft of the character described comprising an inner metal tube extending the full length of the shaft, means as-

6

sociated with the ends of said tube for mounting said shaft for rotation, an air inlet valve located at one end of said tube, a sealing plug at the other end of said tube, an air exhaust valve carried by said tube, a plurality of longitudinally-extending surface segments on the outside of said tube and spaced from said tube, a plurality of pins extending radially inwardly from the inside face of each of said surface segments, positioning collars secured on said tube, radially-extending recesses in said collars for slidably accommodating said pins, retaining rings on said tube, each of said retaining rings having an elongated center opening permitting movement of the retaining ring in a direction perpendicular to the axis of said tube, each surface segment secured to a plurality of said retaining rings, said pins, collars, recesses and rings combining to permit restricted radial movement of said surface segments with respect to said tube, springs mounted on said retaining rings exerting a force to pull said surface segments inwardly as far as permitted by said center openings, a plurality of inflatable rubber rings axially spaced about said tube inside said surface segments, a channel connecting each of said inflatable rings with the interior of said tube, slides mounted on longitudinal edges of said surface segments so arranged as to extend over the gaps between said surface segments when said surface segments are in expanded position to prevent blowouts occurring in said inflatable rings at such gaps, and adjustable metal walls at the ends of said inflatable rings to guard against blowouts at said ends of said inflatable rings.

5. In an expansible winder shaft of the character described, an inner metal tube, an air inlet valve connected with said tube, a plurality of longitudinally-extending cylindrical surface segments on the outside of said tube and spaced from said tube, a plurality of rigidly-mounted pins extending radially inwardly from the inside face of each of said surface segments, positioning collars secured on said tube, radially-extending recesses extending inwardly in said collars for slidably accommodating said pins, means limiting the radial movement of said surface segments with respect to said tube, and a plurality of inflatable resilient rings axially spaced about said tube inside said surface segments, a channel connecting each of said inflatable rings with the interior of said tube.

6. In an expansible winder shaft of the character described, an inner metal tube, an air inlet valve connected with said tube, a plurality of longitudinally-extending cylindrical surface segments on the outside of said tube and spaced from said tube, means connecting said surface segments and said tube permitting radial movement of said segments with respect to said tube, retaining rings on said tube, each of said retaining rings having an elongated center opening permitting movement of the retaining ring in a direction perpendicular to the axis of said tube, each surface segment secured to a plurality of said retaining rings, and a plurality of inflatable resilient rings axially spaced about said tube inside said surface segments, a channel connecting each of said inflatable rings with the interior of said tube.

7. The combination set forth in claim 6 with the addition of springs mounted on said retaining rings and on opposite sides of said openings and exerting a force to pull said surface segments inwardly as far as permitted by said center openings.

8. In an expansible winder shaft of the character described, an inner metal tube, an air inlet valve connected with said tube, a plurality of longitudinally-extending cylindrical surface segments on the outside of said tube and spaced from said tube, means connecting said surface segments and said tube permitting radial movement of said segments with respect to said tube while holding said surface segments against longitudinal movement on said tube, means limiting the radial movement of said surface segments with respect to said tube, a plurality of inflatable resilient rings axially spaced about said tube inside said surface segments, a channel connecting each of said inflatable rings with the interior of said tube, means mounted on longitudinal edges of said surface segments so arranged as to extend over the gaps between said surface segments when said surface segments are in expanded position to prevent blowouts occurring in said inflatable rings at such gaps, and adjustable

metal walls at the ends of said inflatable rings to guard against blowouts at said ends of said inflatable rings.

LEWIS L. COLLARD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
749,114	Surmann et al.	Jan. 5, 1904
1,225,929	Crabtree	May 15, 1917
1,492,291	Giovannoni	Apr. 29, 1924
2,145,806	Schnedarek	Jan. 31, 1939
2,289,519	Randall	July 14, 1942

FOREIGN PATENTS

Number	Country	Date
8,543	Great Britain	Apr. 22, 1896