Oct. 29, 1963 A. T. WILLIAMS ETAL 3,108,757

MANDREL WITH EXPANSIBLE CHUCKS

Filed June 30, 1960 2 Sheets-Sheet 1

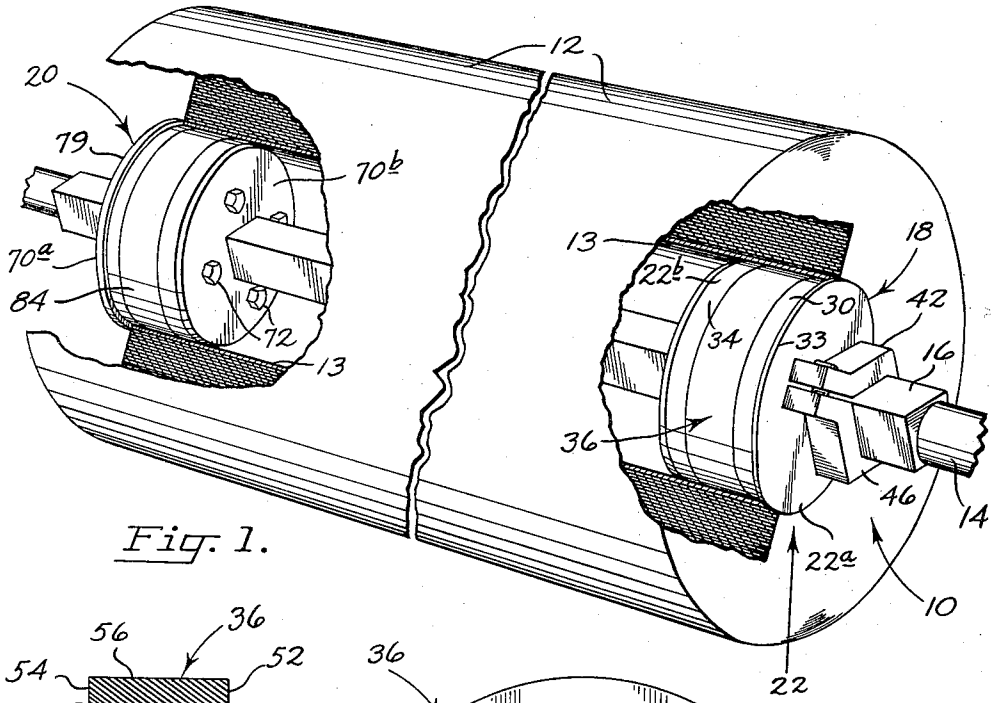

Fig. 1.

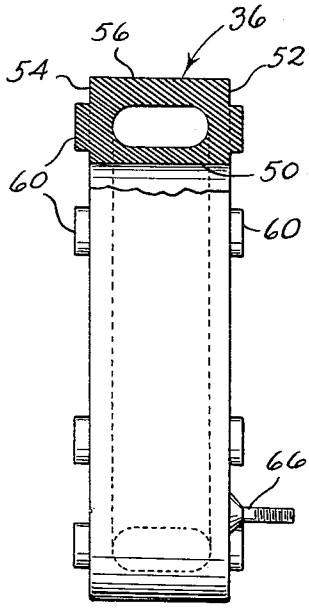

Fig. 6.

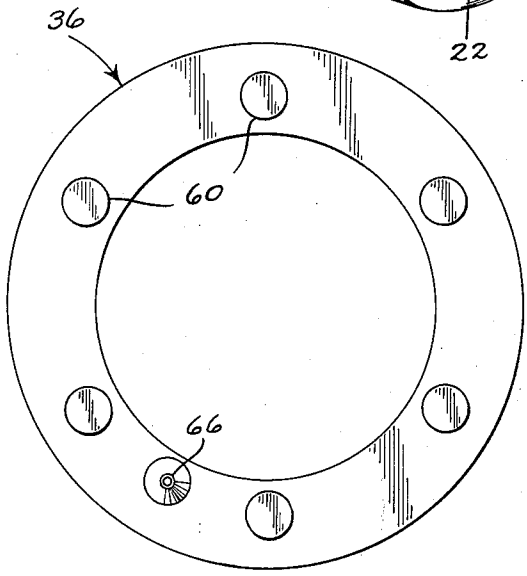

Fig. 7.

Charles R. Tidland
Arthur T. Williams
INVENTORS

BY Ramsey and Kolisch
Attys.

Oct. 29, 1963 A. T. WILLIAMS ETAL 3,108,757

MANDREL WITH EXPANSIBLE CHUCKS

Filed June 30, 1960 2 Sheets-Sheet 2

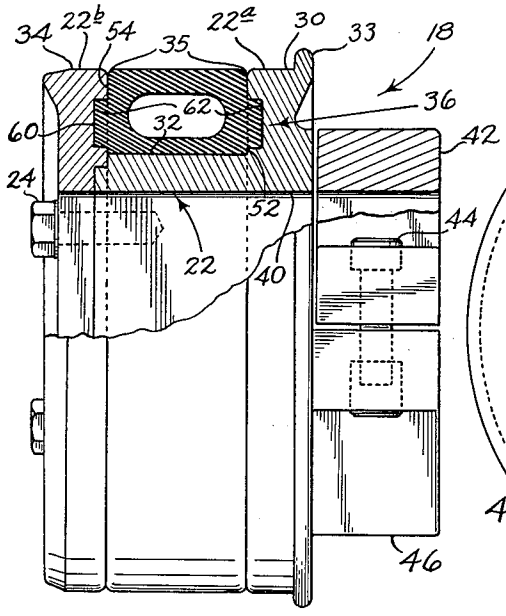

Fig. 2.

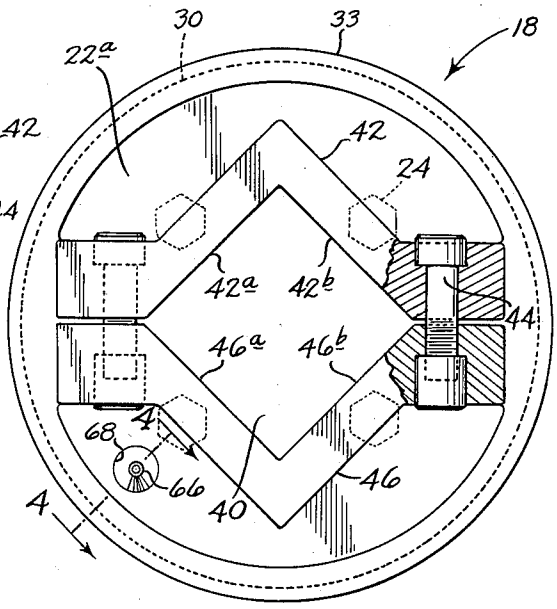

Fig. 3.

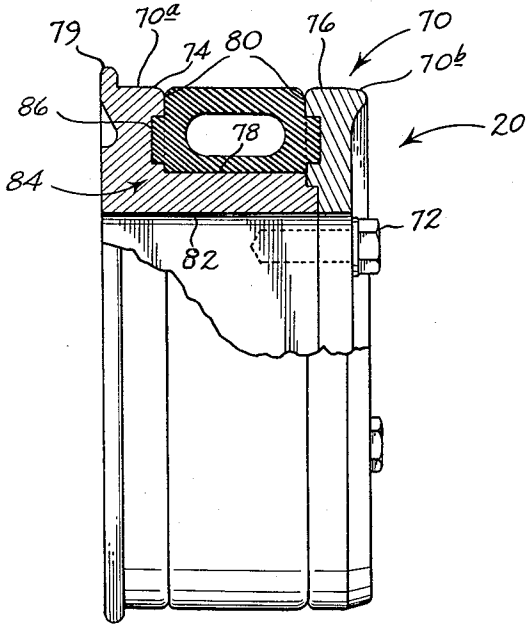

Fig. 5.

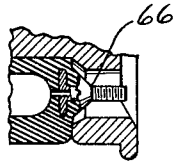

Fig. 4.

Charles R. Tidland
Arthur T. Williams
INVENTORS

BY Ramsey and Kolisch
Attys.

United States Patent Office 3,108,757 Patented Oct. 29, 1963

3,108,757

MANDREL WITH EXPANSIBLE CHUCKS

Arthur T. Williams and Charles R. Tidland, both of P.O. Box 1014, Camas, Wash.

Filed June 30, 1960, Ser. No. 39,897
3 Claims. (Cl. 242—68.2)

This invention relates to expansible chucks, and to a mandrel construction comprising a shaft with expansible chucks spaced axially thereon for the support of a hollow roll core.

Web material such as paper, cloth, etc., commonly is wound and rewound on tubular roll cores during the process of producing and distributing the material. In the winding and rewinding of such material, there is a need for mandrel mechanism that quickly and easily may be inserted within the roll core, and that can then be actuated so as to grab the inside of the core with sufficient firmness whereby the roll core and material wound thereon may be rotated by rotation of the mandrel. This invention contemplates a mandrel having axially spaced chuck mechanisms supported on a shaft, each of the chuck mechanisms including inflatable expansible means whereby after the chuck mechanisms are inserted within a roll core, they may be made securely to grab the core. The invention concerns a novel construction for the mandrel, as well as a novel construction for each chuck mechanism. The invention is a continuation-in-part of an application, now abandoned, filed September 12, 1958, S.N. 760,623, entitled Pneumatic Chuck for Roll Cores.

Among the objects and features of the invention is the provision of a novel form of mandrel that accommodates itself easily to differences in the lengths of roll cores. According to the invention, an improved form of mandrel is contemplated that comprises a pair of inflatable expansible chuck mechanisms on a shaft for effecting contact with the inside of a roll core, one being fixed to the shaft and including a stop flange that indexes one end of a roll core positioned thereon, and the other being nonrotable but axially shiftable on the shaft and having a stop flange that in operative position is abutted against the opposite end of a roll core. On expansion of the inflatable chuck mechanisms, each grabs an end of the roll core, and drive to the core may be transmitted from the shaft to the core through both chucks that are nonrotatable on the shaft. Axial shifting of the floating chuck is inhibited after inflation by reason of its contact with the roll core.

An object of the invention also is to provide an improved form of chuck mechanism especially constructed to withstand, over long operating periods, the high torques to which such a chuck mechanism typically may be exposed. Thus, the chuck mechanism comprises a removable, inflatable, annular envelope of elastic material, and this is supported in the chuck mechanism between opposed flanges provided in a mounting for the envelope. The mounting is split, and easily broken down to enable removal of the envelope. Mechanism also is provided positively locking together the expansible envelope and mounting, whereby the two rotate as one. The interlocking mechanism establishes a firm driving connection between the mounting and the expansible envelope with the mounting in operative position, but, with the mounting broken down, the interlocking mechanism disengages easily.

A more specific object of the invention is to provide a means for interlocking the annular envelope in a chuck mechanism with its mounting which comprises lugs projecting axially from radially extending walls closing off the axial ends of the envelope. The radial walls provide the most effective means for imparting rotation from the chuck mechanism to the envelope, as these join directly with outer circumferential wall portions of the envelope that clamp onto the inside of a roll core. There is no twisting caused by the lugs of the inner circumferential wall of the envelope relative to its outer circumferential wall. Also, the torque load on the lugs themselves is reduced to a minimum by positioning them as far as possible radially outwardly on the envelope.

Another object is to provide an inflatable annular envelope, specifically designed for easy replacement, that has means for locking it on a mounting and means for inflating it that are operatively positioned by axial shifting of the envelope into a mounting.

Other objects and advantages are attained by the invention, and the same is described hereinbelow in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a roll, such as roll of paper, having a hollow roll core and with the core mounted on spaced-apart chuck mechanisms in a mandrel, as contemplated by this invention, with portions of the roll and roll core broken away;

FIG. 2 is a side view, somewhat enlarged, of a fixed chuck mechanism that is part of the mandrel in FIG. 1, with portions of the chuck mechanism broken away;

FIG. 3 is a view of the right end of the chuck mechanism shown in FIG. 2;

FIG. 4 is a cross-sectional view, taken along the line 4—4 in FIG. 3, illustrating details of the valve stem for an inflatable envelope in the invention;

FIG. 5 is a side view, somewhat enlarged and with portions broken away, of a floating chuck mechanism of the mandrel in FIG. 1;

FIG. 6 is a side view of an inflatable elastic envelope employed in each of the chuck mechanisms; and

FIG. 7 is an end view of the inflatable envelope shown in FIG. 6.

Referring now to the drawings for a description of a particular embodiment of the invention, and with reference now in particular to FIG. 1, **10** indicates generally a mandrel mounting a roll of webbing such as paper. The paper roll is indicated at **12**, and is wound on a hollow roll core **13**. Mandrel **10** comprises an elongated shaft **14**, which may be power driven by conventional means (not shown), having intermediate its ends a section **16** of polygonal or square cross section. Supported on section **16** of the shaft, and spaced axially therealong, are a pair of chucks or chuck mechanisms, indicated at **18** and **20**.

Chuck mechanism **18**, as will be described, is clamped to section **16** so that its relative axial position on the shaft section is fixed. Thus, this chuck is referred to as a "fixed" chuck. Chuck mechanism **20**, on the other hand, is axially shiftable on shaft section **16**, and is referred to herein as a "floating" chuck or chuck mechanism.

Considering first of all fixed chuck **18**, and referring now to FIGS. 2 and 3, the chuck comprises a split mounting **22** made up of an annular rim member **22***a*, and detachably secured to rim member **22***a* and axially aligned and adjacent the member, an annular retainer member **22***b*. Rim and retainer members **22***a*, **22***b* are detachably secured together by screws **24**. These extend through accommodating bores provided in the retainer member and are screwed into accommodating threaded bores provided in the rim member.

Rim member **22***a* comprises an annular shoulder or flange **30** having a diameter shaped to fit snugly within the hollow core of a roll, as illustrated in FIG. 1. Integral with and extending in an axial direction to one side of the shoulder or flange is a stem portion **32**. The stem portion has a diameter that is reduced from the diameter of shoulder **30**. Bordering shoulder **30** along the margin of the shoulder that is closer to the end of shaft section **16** is an annular stop flange **33**.

Retainer member 22*b* that is joined to the rim member is provided with an encompassing annular flange or shoulder 34. Shoulder 34 has a diameter shaped to fit snugly within the core of the roll, as shown in FIG. 1, and thus has a diameter corresponding to the diameter of shoulder 30. With the rim and retainer members secured together as in FIGS. 1, 2, 3, shoulders 30, 34 and stem 32 together define an elongated continuous recess 35 extending circumferentially around split mounting 22. The recess is used to mount an annular inflatable envelope of elastic material, generally indicated at 36, which later will be described in more detail.

Split mounting 22 has a passage or channel 40 extending axially through its center. Passage 40 has a cross section which is polygonal or square, and complements the cross section of shaft section 16. Thus, with the split mounting mounted on the shaft section, the two are keyed for relative rotation.

The fixed chuck is secured on shaft section 16 from axial shifting therealong by means of a clamping member 42 secured as by screws 44 to a clamping flange 46 integral with the rim member. Clamping member 42 has walls 42*a*, 42*b* at right angles to each other that fit over two of the sides of square shaft section 16. The clamping flange, in a similar manner, has walls 46*a*, 46*b* at right angles to each other that fit over the other two sides of the shaft section. When the clamping member is brought down on the clamping flange, the two grab the shaft section 16 and firmly hold mounting 22 in place.

Considering now annular inflatable envelope 36, this is shaped as a doughnut, and has an inner cylindrically shaped circumferential wall 50 adapted to rest on stem portion 32. Joined to wall 50 are radially extending end walls 52, 54. Integral with these end walls and forming the outside of the envelope is a cylindrically shaped circumferential wall 56. With the envelope in place and deflated, a roll is easily slid over outer wall 56 with the core snugly sliding on shoulders 30, 32. On inflation of the envelope, by reason of the confinement of the envelope produced by the stem portion and the shoulders on either side of the envelope, the envelope expands radially outwardly, and outer wall 56 comes into gripping or clamping contact with the inside of the hollow roll core.

The envelope and split mounting are constructed so that with the chuck in operative position, the two are locked from relative rotary displacement. This enables drive to be transmitted to roll 12 from square shaft section 16 through the split mounting and thence the elastic envelope. The construction selected also makes provision for ready disengagement and separation of the envelope from the mounting in the event the envelope need be replaced. Locking of the envelope and split mounting together is done by lug and socket means acting on radial end walls 52, 54. These are joined directly to the outer cylindrical wall 56, and using this construction there is no tendency for wall 56 to be twisted relative to wall 50. Further, the construction enables placement of the means engaging the envelope radially outwardly on the envelope, where torques are not as great as those that could result at other locations, as for example if the lugs were joined to wall 50.

Specifically, and now with reference to FIGS. 2, 6, and 7, equally circumferentially spaced over radial walls 52, 54 are axially extending lugs or buttons 60 integral with the radial walls. These, in the embodiment illustrated, are cylindrical in shape. Recessed into the sides of shoulders 30, 34 are cavities 62 that are cylindrical in shape and complement in size and distribution buttons 60. With the chuck assembled, as in FIGS. 2 and 3, the buttons fit within the cavities, and the envelope and split mounting unite to rotate as one.

Annular envelope 36 is inflated through a valve stem 66 that extends in an axial direction from one of the radial end walls. The valve stem includes a conventional valve mechanism resembling, for instance, the ordinary tire valve, whereby the flow of air into and out of the envelope may be controlled. The valve stem extends through a bore 68 provided the rim member in the assembled chuck, as shown in FIG. 3.

It will be noted that by reason of the axial direction of buttons or lugs 60, and the axial direction of the valve stem, and because the retainer member may be shifted in an axial direction away from the rim member to open recess 35 along the length of the recess, interlocking of the envelope with the mounting is easily accomplished, yet the envelope is readily removable when and if desired. To take the envelope off the mounting, the retainer member at the left in FIG. 2 is first removed. The envelope may then be shifted axially to the left by sliding it over the stem portion with the buttons projecting from radial wall 54 sliding out of cavities 62 and wtih the valve stem sliding axially out of bore 68. To insert a new inflatable envelope, the process is reversed.

Considering floating chuck 20, the construction of this is somewhat similar to that of the fixed chuck just described, save that the clamping flange and clamping member of the fixed chuck are eliminated. Thus, and with reference to FIG. 5, the floating chuck comprises a split mounting 70 made up of rim member 70*a* and retainer member 70*b*. The two parts are detachably secured together by screws 72. Each member of the mounting has an annular shoulder (shoulders 74, 76) and these are separated by a stem 78, with the shoulders and stem defining a recess 80 extending circumferentially about the split mounting. A stop flange 79 corresponds to flange 33 of the other chuck. An axially extending passage or channel 82 of square cross section conforming to the cross section of shaft 16 is provided through the center of the split mounting.

Within recess 80 is an annular inflatable elastic envelope 84. This envelope is of the same size and shape as envelope 36, and is provided with buttons or lugs 86 projecting into accommodating cavities formed in the side walls of shoulders 74, 76. The envelope is replaced as is envelope 36 discussed in connection with the fixed chuck.

Explaining how the mandrel of the invention may be used, the mandrel with the floating chuck removed is inserted through the hollow core of a paper roll, such as paper roll 12. The mandrel is positioned so that one edge of roll core 13 comes into contact with stop shoulder 33 (the shoulder thus indexing the roll). The floating chuck is then slid over the end of shaft 14 and onto shaft section 16 and thence into core 13 until stop flange 79 abuts the opposite edge of core 13. If the inflatable envelopes of the two chucks are then inflated, the inside of the roll core is gripped by the outer walls of the envelopes.

It should be noted that the mandrel can handle with equal facility heavy and light rolls. With a heavy roll, some eccentricity of the roll on the shaft may occur, and when this happens the roll is supported, partially at least, on shoulders 74, 76, 34, 30 of the chucks. As the roll diminishes in size, the roll centers itself, with the envelopes radially expanding substantially uniformly about their circumferences.

It is claimed and desired to secure by Letters Patent:

1. A mandrel adapted to support the inside of a hollow roll core comprising an elongated shaft; a fixed chuck secured to the shaft adjacent one of its ends; and a floating chuck axially slidable on said shaft but nonrotatable relative thereto nearer the other end of the shaft; each of said chucks comprising a mounting having wall portions defining a recess extending circumferentially about the mounting, an annular inflatable means seated within said recess and operable on inflation to enlarge radially and to come into clamping engagement with the inside of a roll core, an inner shoulder on one side and an outer shoulder on the other side of said inflatable means constructed snugly to fit within the roll core, and an annular

stop flange bordering the outer margin of the outer shoulder having a diameter larger than that of the inside of the roll core.

2. A mandrel adapted to support the inside of a hollow roll core comprising an elongated shaft; a fixed chuck secured to the shaft adjacent one of its ends; and a floating chuck axially slidable upon the shaft nearer the other end of the shaft and nonrotatable relative to the shaft; each of said chucks comprising a split mounting having annular rim and retainer members detachably joined together and together having wall portions defining an annular recess extending circumferentially about the mounting, said mounting being constructed so that on detachment of the rim and retainer members said recess is opened up continuously along one side, a unitary inflatable annular envelope of elastic material seated within said recess, a first annular shoulder provided on the mounting on one side of the envelope and a second annular shoulder provided on the mounting on the other side of the envelope, said annular shoulders being constructed to fit snugly within a roll core, said envelope on inflation expanding radially outwardly to project beyond the shoulders and come into clamping engagement with the inside of a roll core, and an annular stop flange bounding the margin of said first shoulder, said stop flange having a diameter larger than that of the inside of the roll core.

3. A mandrel adapted to support the inside of a hollow roll core comprising an elongated shaft; a fixed chuck

secured to said shaft adjacent one of its ends; said fixed chuck having a radially enlargeable annular surface adapted to fit within a roll core, and abutment means for abutting the end of a roll core spaced toward said one end of said shaft from said surface; and a floating chuck slidably mounted on said shaft but nonrotatable relative to the shaft; said floating chuck being spaced toward the opposite end of said shaft from said fixed chuck; said floating chuck having a radially enlargeable annular surface adapted to fit within a roll core, and abutment means for abutting the end of a roll core spaced toward said opposite end of the shaft from its said annular surface.

References Cited in the file of this patent

UNITED STATES PATENTS

2,134,475	Green	Oct. 25, 1938
2,145,806	Schnedarek	Jan. 3, 1939
2,285,966	Hamilton	June 9, 1942
2,449,654	Jessop	Sept. 21, 1948
2,583,117	Piperoux et al.	Jan. 22, 1952
2,585,999	Bunch	Feb. 19, 1952
2,697,563	Miller	Dec. 21, 1954
2,707,082	Collard et al.	Apr. 26, 1955
2,857,749	Fabbri et al.	Oct. 28, 1958

FOREIGN PATENTS

505,102	Canada	Aug. 17, 1954
545,303	Canada	Aug. 27, 1957