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(54) **Apparatus suitable for use in winding rolls of material.**

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Description

This invention relates to an apparatus suitable for use in winding rolls of material, comprising: an expansible tube being sealingly fitted over a shaft having at least one passageway for introducing expansion fluid.

In a known apparatus of the art mentioned before (see DE—U—7 220 630) the passageway for introducing expansion fluid is formed inside the shaft as an axial bore connected on its end related to the expansible tube with two other bores, extending rectangularly to said first bore. Furthermore, the means for preventing expansion of selected parts of the expansible tube are only two rings, each of them being arranged on end portions of the expansible tube. This apparatus known in the art is affected with some drawbacks, especially in that providing bores extending inside the shaft causes some problems while manufacturing them and using only rings as means for preventing expansion of selected parts of the expansible tube leads to an expansion of nearly the whole expansible tube, i.e. leads to a relatively big pressure volume between the expansible tube and the shaft and therefore to a relatively big sealing time.

In an another known apparatus (see DE—A—2 939 649), the passageway for the fluid is built through a hollow shaft and from said hollow shaft extending radial bores. The means for preventing expansion of selected parts of the expansible tube are in in that known apparatus only formed in that the expansible tube is vulcanized onto the shaft except in regions of the radial borings of the shaft. The hollow shaft with the radial borings leads again to a relatively big expansion volume, i.e. leads again to a relatively long sealing time. Further, vulcanization of the expansion tube on the shaft except of selected portions is a relatively expensive method of manufacturing too.

In conventional machines for winding rolls of paper it has been necessary to provide an intermediate or spacer member, for example a cylindrical carboard support, between the winding shaft and the roll of paper so that a wound paper roll may be removed from a winding shaft.

Figure 1 of the accompanying drawings illustrates a previously proposed winding machine wherein a hollow cylindrical cardboard support member 102 is placed over a paper winding shaft 101 and held in position on the shaft 101 by a positioning means 103, for example an air bag. The positioning means 103 serves to ensure that the longitudinal axis of the support member 102 remains coaxial with that of the shaft 101 and also to allow for easy removal of a wound paper from the shaft. A pair of driving rollers 2 and 2′ are provided for driving the support 102 and therefore the shaft 101. A weighting roller 4 is provided to apply a downward force to the support member 102, and hence to the shaft 101. The weighting roller 4 is of course vertically movable and the rotational axes of the rollers 2, 2′ and 4 are maintained parallel to the longitudinal axis of the shaft. Continuous paper 3 is fed to the support member 102 via the upper surface of the driving roller and is then wound at least once round the support member to allow the winding torque of the shaft 101 to be transmitted to the next section. The weighting roller 4 is then brought into engagement with the wound paper to provide for smooth and even winding of the paper. The circumferential speeds of the driving rollers 2 and 2′ and weighting roller 4, which rotate in the direction shown by the arrows in Figure 1, are synchronized. The weighting roller 4 which is vertically movable rises as the thickness of paper wound on the support member 102 increases. The paper is wound onto the support member mainly by the rotation of the driving rollers 2 and 2′ and the weighting roller 4′ and not by the rotation of the shaft 101 which serves only to position the support member 102. Radial positioning of the support member 102 is effected by the positioning means 103 while longitudinal positioning of the support member is effected by a pair of thrust bearings (not shown) which are provided at the ends of the shaft 101.

Because the weight of the paper wound onto the support member 102 is born mainly by the driving rollers 2 and 2′, the shaft 101 is not affected by the weight of the paper. Moreover, because the shaft neither transmits a winding torque to nor bears a tensile force on the paper 3, the diameter of the shaft can be made very small.

In order that the support member 102 around which the paper is wound may be removed easily, the support member must have a thickness sufficient to resist deformation under the winding force due to the tensile force produced by the paper and against deformation of the wound paper itself. In practice, it is impossible to make the outer diameter of the shaft less than about 13 mm.

Where the paper roll is for use in a register or a desk type computer, a 50 to 70 mm diameter roll is ordinarily required and it is considered that the support member mentioned above which is usually made of cardboard leads to a roll of paper which is overly bulky for use in small sized apparatus such as a register or a desk type computer.

It is an object of the present invention to provide apparatus suitable for use in winding rolls of material which overcome or at least mitigates the disadvantages of previously proposed apparatus.

According to the present invention there is provided apparatus suitable for use in winding rolls of material, departing from the state of the art, as known through DE—U—7220630, comprising an expansible tube for supporting, in its expanded condition, material being wound into a roll, the expansible tube being sealingly fitted over a shaft, having at least one passageway for introducing expansion fluid, and means for preventing expansion of selected parts of the expansible tube characterized in that said passageway is a groove extending along the surface of

said shaft to allow fluid under pressure to be passed into the tube to cause the tube to expand, and in that said means for preventing expansion of selected parts of the expansible tube comprises an inexpansible sheet fitted over the expansible tube, the expansible sheet being formed with a plurality of perforations through which the expansible tube is allowed to expand.

According to an alternative of the invention, the apparatus based on the disclosure of DE—U—7220630 is characterized in that said passageway is a groove extending along the surface of said shaft to allow fluid under pressure to be passed into the tube to cause the tube to expand; and in that said means comprise a plurality of inexpansible tubular members fitted over the expansible tube and spaced apart along the length of the expansible tube.

The main advantage of the apparatus embodying the present invention is that the apparatus is simple in construction and compatible with conventional winding machines. Also, the apparatus is similarly convenient both for removal of a wound roll and formation thereof.

For a better understanding of the present invention and to show how the same may be put into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a schematic illustration of previously proposed apparatus;

Figure 2 is a diagrammatic part-sectional view of apparatus in accordance with the present invention;

Figure 3 is a cross-sectional view of the apparatus of Figure 2 taken on line III—III of Figure 2; and

Figure 4 is an enlarged side view of part of the apparatus of Figure 1.

Referring now to the drawings, Figures 2 and 4 illustrate apparatus in accordance with the invention. As shown in Figure 2, a shaft 11 comprising a drill rod of 8 mm in diameter has a pair of diametrically opposed keyways 12 formed on its exterior surface and extending longitudinally of the shaft. The keyways 12 are both connected to a distribution conduit 13 which extends radially through the rod 11 and thus connects the keyways 12 together. The distribution conduit 13 is also connected to a vent pipe 14 which extends along the axis of the shaft to one end thereof. The one end of the shaft has an external screw-thread for connection to one end of a sleeve 15. The other end of the shaft 11 is rounded to form a hemi-spherical end 16 which in use of the apparatus bears against a thrust bearing (not shown).

The sleeve 15 incorporates a vent pipe 18 which is connected to the vent pipe 14 of the shaft 11. A check valve 17 is provided at the other end of the sleeve 15. The check valve 17 may be, for example, a ball check valve. The sleeve 15 is connected by a screw-thread connection to one end of a cover 19 so that the cover 19 may be easily removed. The other end 24 of the cover 19 is hemi-spherically shaped to bear in use on a thrust bearing (not shown).

An expansible tube 20 made of rubber or a plastics material having expansible properties, which may be, for example, of 7 mm diameter and 1.5 mm thickness, fits tightly over the shaft 11 which as mentioned above has an outer diameter of 8 mm. The open ends of the tube 20 are bound to the shaft 11 by fastening means 30 and 31, for example piano wire wound round the ends of the tube, so that the tube is kept airtight. The rubber tube 20 extends along the shaft 11 over the area that will be covered by the paper to be wound onto the shaft. Thus, the tube is of 900 mm in length, equivalent to the greater part of the length of the shaft. Insertion of the shaft 11 into the tube 20 can be effected easily by supplying air or other suitable fluid under pressure to the keyways 12, via the check valve 17, vent pipes 18 and 14 and the distribution conduit 13 to cause the tube to expand.

A hard inexpansible sheath 21 fits tightly over the expansible tube 20. The sheath 21 is applied to the tube 20 by initially covering the rubber tube 20 with a heat-contractible plastics tube for example a bridged or crosslinked polyolefin tube. The heat contractible tub is then heated causing the plastics tube to contract to form tightly round the tube 20. The sheath 21 is then cooled and hardens. It is desirable to use such heat-contractible plastics tube because the thickness of the contracted sheath will be about 0.6 mm. Holes 23 of 3 mm diameter are provided on the circumferential surface of the sheath 21 extending in rows longitudinally of the sheath 21 and separated by 10 mm so as to extend uniformly over the whole surface of the sheath as shown in Figure 4. It is desirable for the holes 23 to be produced in the contractible tube before it is fitted over the expansible tube 20.

Prior to commencing a winding operation, the cover 19 is removed from the shaft. Air under pressure, for example at a pressure of 4—5 kg/cm^2 (4×10^{-5} to 5×10^{-5} Nm^{-2}), is supplied from the check valve 17 to the keyways 12 via the vent pipes 18 and 14 and distribution conduit 13. Air thus enters the space between the shaft 11 and the expansible rubber tube 20 against the tensile strength thereof. The rubber tube 20 will therefore expand uniformly through all the holes 23 in the sheath 21 to form hemispherical protrusions extending from the holes 23. The air supply is cut-off so that the circumferential hemi-spherical protrusions formed in the tube 20 extend by about 1 mm from the surface of the sheath.

The cover 19 is then reconnected to the shaft and the shaft is then installed in a winding machine such as that shown in Figure 1. A continuous sheet of paper or other material is then fed to the shaft and is wound at least once directly round the shaft to secure it in place. A weighting roller 4 is then lowered onto the wound paper and driving rollers 2 and 2' are driven to rotate the shaft causing the paper or other

material to be wound onto the shaft.

Although during the winding operation the hemi-spherical protrusions of the tube 20 may be subjected to a winding force caused by the tensile strength of the paper or the material being wound, the winding force is, in practice, negligible so that the paper wound onto the shaft rests on the hemi-spherical protrusions of the tube 20 and does not touch the sheath itself. Consequently, when a certain predetermined length of paper is wound on the shaft, paper rolls of uniform size can be obtained.

After a winding operation, the wound roll of paper or other material may easily be removed from the shaft. Thus, first the shaft itself together with the paper or other material retained thereon is removed from the winding apparatus and the cover 19 is removed so that the check valve may be opened to deflate the rubber tube 20 allowing the roll of paper or other material to be removed from the shaft.

Although, in the apparatus described above, a shaft of 8 mm diameter is used, it may be practicable to use on 5 mm diameter shaft enabling more paper or other material to be wound into the same size roll as would be made by a larger shaft. It should therefore be understood that the size or length of the shaft is not limited to that described above.

Moreover, instead of keyways which extend longitudinally of the shaft 11, a spiral groove or spiral grooves may be provided on the circumferential surface of the shaft.

Also, instead of a hard sheath which covers a large area of the shaft, heat-contractible plastics tape of, for example, 5 mm width, may be wound in a spiral onto the expansible tube 20 to form a spiral space of, for example, 5 mm width, through which the tube 20 may expand. Alternatively, cylindrical sheaths formed from heat-contractible plastics tubing may be provided at intervals of, for example, 5 mm along the length of the tube 20, so that the exanpsible tube 20 may expand between them.

Claims

1. Apparatus suitable for use in winding rolls of material, comprising: an expansible tube (20) for supporting, in its expanded condition, material being wound into a roll, the expansible tube (20) being sealingly fitted over a shaft (11) having at least one passageway for introducing expansion fluid, and means for preventing expansion of selected parts of the expansible tube (20), characterized in that said passageway is a groove (12) extending along the surface of said shaft (11) to allow fluid under pressure to be passed into the tube to cause the tube to expand; and in that said means for preventing expansion of selected parts of the expansible tube (20) comprises an inexpansible sheet fitted over the expansible tube (20), the expansible sheet being formed with a plurality of perforations (23) through which the expansible tube (20) is allowed to expand.

2. Apparatus according to claim 1, characterized in that the perforations (23) are of a size such that when the expansible tube (20) is expanded, the parts of the tube (20) projecting through the perforations (23) have a hemi-spherical shape.

3. Apparatus suitable for use in winding rolls of material, comprising: an expansible tube (20) for supporting, in its expanded condition, material being wound into a roll, the expansible tube (20) being sealingly fitted over a shaft (11) having at least one passageway for introducing expansion fluid, and means for preventing expansion of selected parts of the expansible tube (20), characterized in that said passageway is a groove (12) extending along the surface of said shaft (11) to allow fluid under pressure to be passed into the tube to cause the tube to expand; and in that said means comprise a plurality of inexpansible tubular members fitted over the expansible tube (20) and spaced apart along the length of the expansible tube (20).

4. Apparatus according to any preceding claim, characterized in that the means for preventing expansion of selected parts of the expansible tube (20) is formed of a heat contractible plastics material.

5. Apparatus according to any preceding claim, characterized in that the or each groove (12) is connected to valve means (17) for controlling the supply of fluid to the expansible tube (20).

6. Apparatus according to any preceding claim, characterized in that the shaft (11) has a removable cover means (19) at one end thereof.

7. Apparatus according to claim 6, characterized in that an outer end of the cover means (19) is of hemispherical shape for seating in a thrust bearing.

8. Apparatus according to claim 6 or 7, characterized in that the other end of the shaft (11) is of hemi-spherical shape for seating in a thrust bearing.

Revendications

1. Appareil utilisable pour l'enroulement de rouleaux de matériau, comprenant: un tube expansible (20) pour supporter, lorsqu'il est expansé, le matériau étant enroulé en un rouleau, le tube expansible (20) enveloppant hermétiquement un arbre (11) pourvu d'au moins un passage. pour introduire un fluide d'expansion, et des moyens pour empêcher l'expansion de parties déterminées du tube expansible (20), caractérisé en ce que ledit passage est un sillon (12) s'étendant le long de la surface dudit arbre (11) pour permettre au fluide sous pression d'être envoyé dans le tube afin que le tube s'expanse, et en ce que lesdits moyens pour empêcher l'expansion de parties déterminées du tube expansible (20) comprennent une nappe non expansible enveloppant le tube expansible (20), la nappe non expansible étant pourvue d'une pluralité de perforations (23) à travers lesquelles le tube expansible (20) peut s'expanser.

2. Appareil selon la revendication 1, caractérisé

en ce que les perforations (23) sont d'une taille telles que, lorsque le tube expansible (20) est expansé, les parties du tube (20) saillantes à travers les perforations (23) ont une forme hémisphérique.

3. Appareil utilisable pour l'enroulement de rouleaux de matériau, comprenant: un tube expansible (20) pour supporter, lorsqu'il est expansé, le matériau étant enroulé en un rouleau, le tube expansible (20) enveloppant hermétiquement un arbre (11) pourvu d'au moins un passage pour introduire un fluide d'expansion, et des moyens pour empêcher l'expansion de parties déterminées du tube expansible (20), caractérisé en ce que ledit passage est un sillon (12) s'étendant le long de la surface dudit arbre (11) pour permettre au fluide sous pression d'être envoyé dans le tube afin que le tube s'expanse, et en ce que lesdits moyens comprennent une pluralité d'éléments tubulaires non expansibles entourant le tube expansible (20) et espacés par des intervalles le long du tube expansible (20).

4. Appareil selon l'une des revendications précédentes, caractérisé en ce que les moyens pour empêcher l'expansion de parties déterminées du tube expansible (20) sont réalisés dans un matériau plastique rétractable à la chaleur.

5. Appareil selon l'une des revendications précédentes, caractérisé en ce que le, ou chaque sillon (12) est relié à des moyens formant soupape (17) pour commander l'amenée de fluide vers le tube expansible (20).

6. Appareil selon l'une des revendications précédentes, caractérisé en ce que l'arbre (11) est pourvu de moyens formant couvercle amovible (19) à l'une des ses extrémités.

7. Appareil selon la revendication 6, caractérisé en ce qu'une extrémité extérieure des moyens formant couvercle (19) est de forme hémisphérique pour reposer sur un palier de butée.

8. Appareil selon l'une des revendications 6 ou 7, caractérisé en ce que l'autre extrémité de l'arbre (11) est de forme hémisphérique pour reposer sur un palier de butée.

Patentansprüche

1. Vorrichtung für Wickelrollen, mit einer ausdehnbaren Röhre (20), die in ihrem ausgedehnten Zustand auf die Rolle aufgewickeltes Material trägt, wobei die ausdehnbare Röhre (20) abdichtend über eine mit wenigstens einem Durchlaß eines Expansionsfluids versehene Welle (11) aufgesetzt ist und mit Mitteln zum Verhindern der Dehnung bestimmter Teile der dehnbaren Röhre (20), versehen ist, dadurch gekennzeichnet, daß

— der Durchlaß als Kerbe (12) ausgebildet ist, die sich entlang der Fläche der Welle (11) erstreckt, um unter Druck in die Röhre (12) zur Verursachung einer Dehnung der Röhre (20) geführtem Fluid zu ermöglichen, und

— die Mittel zum Verhindern der Dehnung der bestimmten Teile der dehnbaren Röhre (20) ein über die dehnbare Röhre (20) aufgesetztes nicht-dehnbares Blatt aufweisen, das mit einer Vielzahl von Perforationen (23) versehen ist, durch die die dehnbare Röhre (20) expandieren kann.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Perforationen (23) von einer solchen Größe sind, daß bei einer Dehnung der dehnbaren Röhre (20) die durch die Perforationen (23) ragenden Teile der Röhre (20) halbkugelförmig sind.

3. Vorrichtung für Wickelrollen, mit einer ausdehnbaren Röhre (20), die in ihrem ausgedehnten Zustand auf die Rolle aufgewickeltes Material trägt, wobei die ausdehnbare Röhre (20) abdichtend über eine mit wenigstens einem Durchlaß eines Expansionsfluids versehene Welle (11) aufgesetzt ist und mit Mitteln zum Verhindern der Dehnung bestimmter Keile der dehnbaren Röhre (20), dadurch gekennzeichnet, daß

— der Durchlaß als Kerbe (12) ausgebildet ist, die sich entlang der Fläche der Welle (11) erstreckt, um unter Druck zur Verursachung einer Dehnung in die Röhre geführtem Fluid eine Dehnung der Röhre zu verursachen, und

— die Mittel eine Vielzahl von nicht-dehnbaren rohrförmigen Elementen aufweisen, die über die dehnbare Röhre (20) gesetzt und mit Abstand voneinander über die Länge der dehnbaren Röhre (20) angeordnet sind.

4. Vorrichtung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß das Mittel zum Verhindern der Expansion der bestimmten Teile der dehnbaren Röhre (20) aus einem unter Wärme schrumpfenden Kunststoff besteht.

5. Vorrichtung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die oder jede Kerbe (12) mit einem Ventil (17) zum Steuern der Speisung des Fluids in die dehnbare Röhre (20) verbunden ist.

6. Vorrichtung nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Welle (11) an seinem einen Ende eine entfernbare Abdeckung (19) aufweist.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß ein äußeres Ende der Abdekkung (19) halbkugelförmig als Sitz in einem Drucklager ausgebildet ist.

8. Vorrichtung nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß das andere Ende der Welle (11) halbkreisförmig als Sitz in einem Drucklager ausgebildet ist.

FIG.1

PRIOR ART

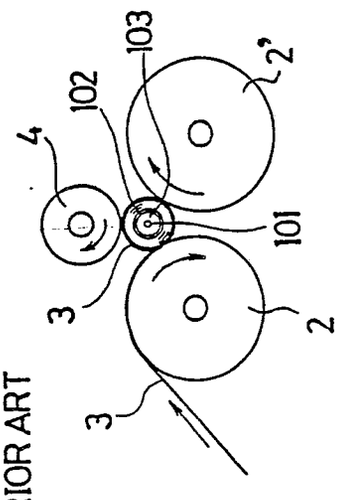

FIG.2

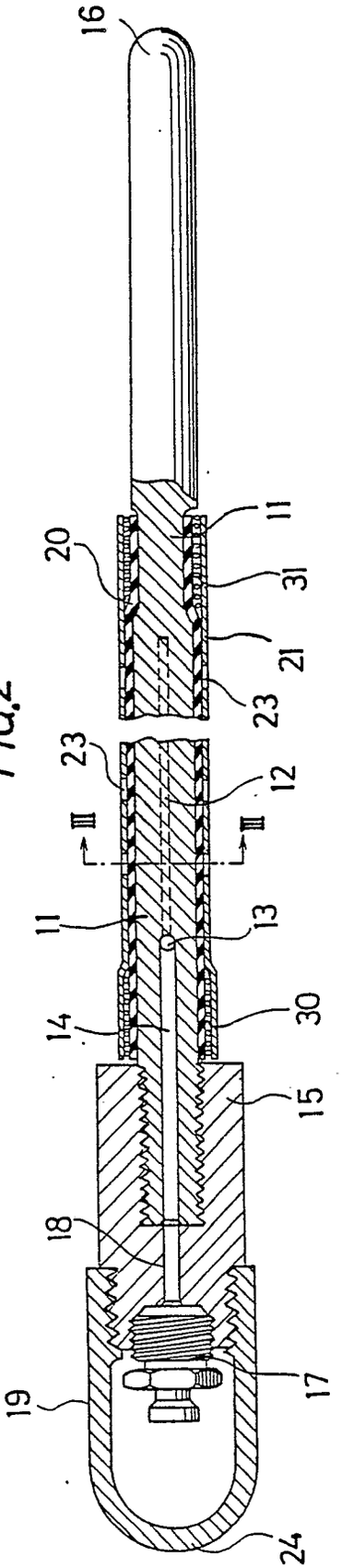

FIG.3

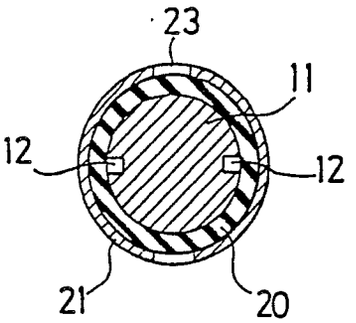
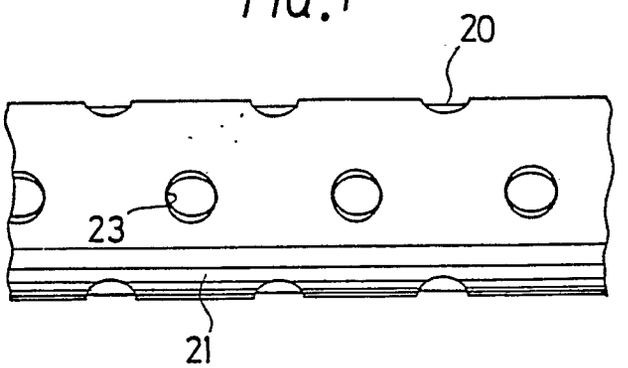
FIG.4