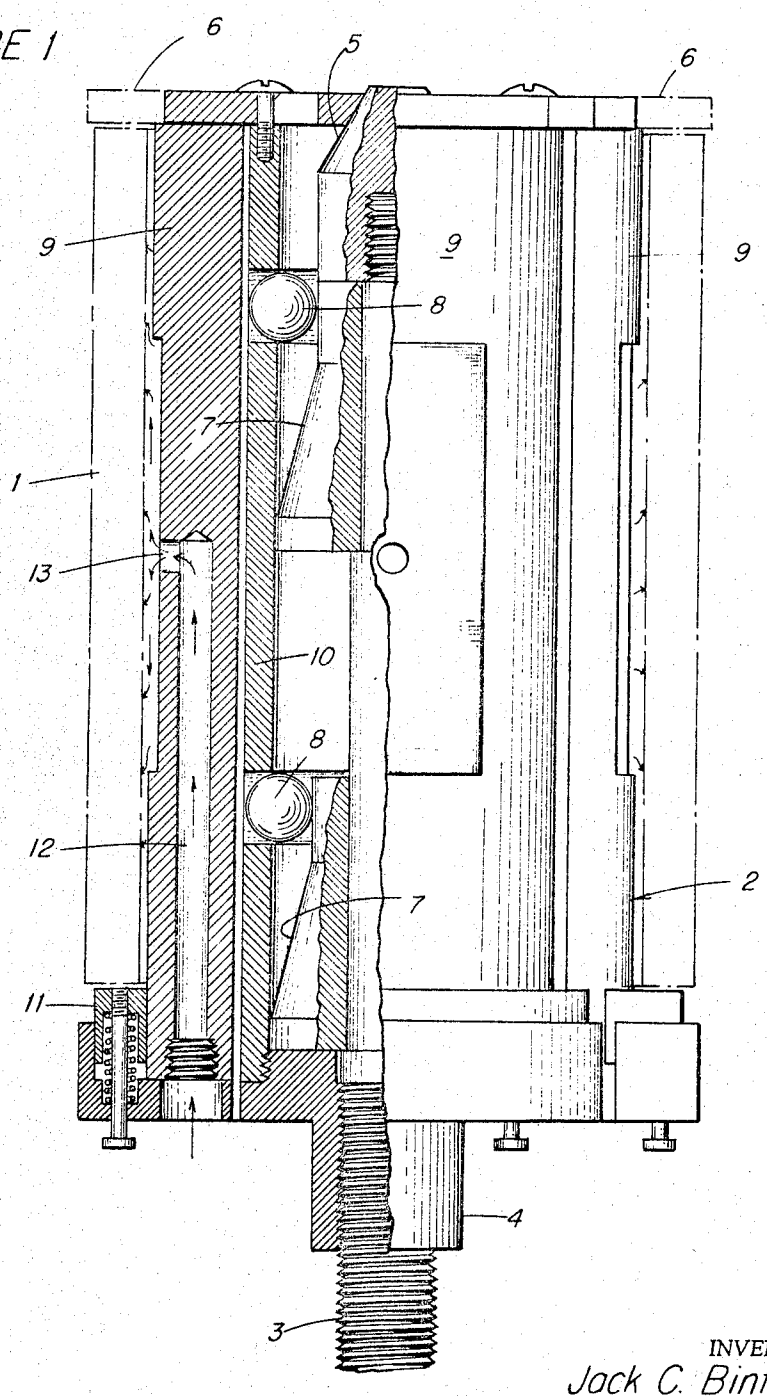
Oct. 4, 1966 J. C. BINFORD 3,276,718

NON-ROTATING WINDUP CHUCK

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FIGURE 1



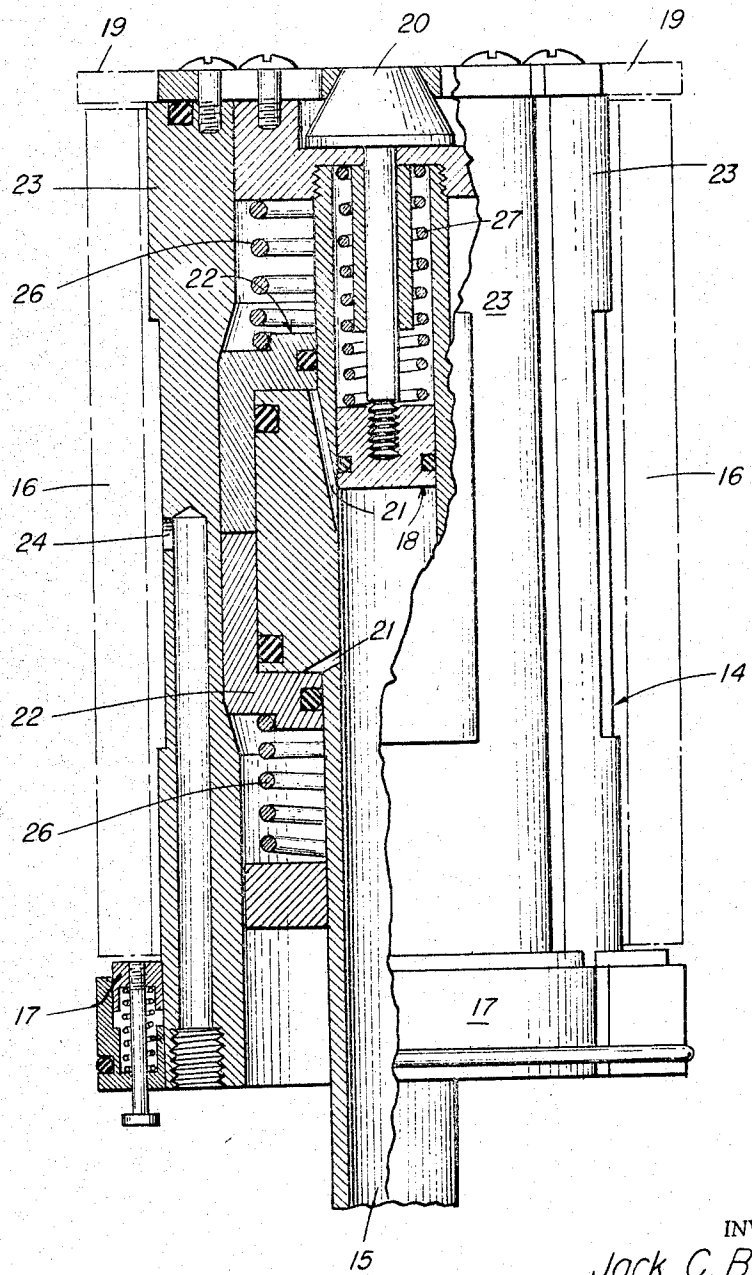
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FIGURE 2



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NON-ROTATING WINDUP CHUCK

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Filed Dec. 4, 1964, Ser. No. 416,049
3 Claims. (Cl. 242—129.5)

This invention relates to a unique apparatus useful in winding filamentary structures onto a surface driven package, and, more particularly, to a non-rotating windup chuck.

In the textile industry, yarns, threads, and other filamentary structures are often wound on tubular cores removably supported on rotatable chucks. In order to achieve high winding speeds and for other purposes, it has been found practicable to rotate the chuck-core assembly by a rolling contact with a drive roll.

A number of advantages derive from the use of rotating windup chuck described above, primary among which are increased winding speed and simplicity of operations. One of the principal shortcomings of a rotating chuck is the necessity to have the chuck and tubular core in proper balance to avoid excessive wear of the chuck. The difficulties of balancing are greatly accentuated by utilizing a tubular core for winding thread which may and generally has a non-uniform inner surface setting up an unbalanced condition of the rotating windup chuck and tubular core. This unbalanced effect can provide excessive wear on the chuck and require extensive maintenance. As is known, the unbalanced force is proportional to the weight and the square of the speed. Since a rotating chuck is quite heavy and the highest speed of the chuck is desirable to wind up threads, the unbalanced force is a significant factor which must be considered in order to reduce maintenance costs.

It is the object of the present invention to provide a unique apparatus in the form of a non-rotating chuck which can be used at excessive speeds and will eliminate the undesirable unbalanced forces due to the rotating chuck in the winding of filamentary material and significantly decrease maintenance costs in regard to wear of the chucks. Other objects will become apparent to those skilled in the art by the detailed description which follows.

A non-rotating windup chuck has been discovered which utilizes the principle of gas or air pressure on which a tubular package core for yarns, threads, and the like, can be rotated around the windup chuck by surface driven roll contact. This can be accomplished by placing a tubular package core or bobbin over a non-rotating elongated chuck body which has gas or air issuing from ports or openings on its surface with the result that the bobbin will be supported by the pressure of the gas or air. Contacting the bobbin with the drive roll, the bobbin will rotate supported on the cushion of gas or air. Yarns can then be wound onto the bobbin using suitable traversing mechanisms available.

The over-all principle of the apparatus of this invention relates to the flow of gas or air from the elongated chuck body which escapes through the clearance between the outer surface of the elongated chuck body and inner surface of the rotatable tubular package core or bobbin. This gas or air under pressure provides the cushioning effect on which the bobbin rotates. The amount of air or gas flow dictates the economics of the apparatus, thus the clearance between the elongated chuck body and inner surface of the bobbin must be kept as low as possible. If the tolerance of the bobbin inside diameter is closely controlled, the elongated chuck body can be made of a fixed diameter with air or gas flow cost balanced against the ability to load and unload the bobbin from the elongated chuck body and further determined by the pressures required to maintain the rotating load. If, on the other hand, the inside diameter of the bobbin is variable as is generally the case with paper bobbins, the elongated chuck body must be capable of a variable diameter to match the bobbin diameter or other means of compensation must be found. One method of compensation is by utilizing an elongated chuck body which has expansible and retractable sides with at least one air port in each segment to adjust to the inner diameter of the bobbin. Another method of compensations could be to increase the gas or air flow to maintain the cushioning pressure at increased cost. An additional method of compensation is to utilize a set of end cams similar to mechanical seals which would restrict the escape of air or gas.

If the elongated chuck body must be variable, a multi-unit apparatus is most practicable since each pad must be expanded to a given radius. This expansion can be obtained mechanically or by incorporating the desired effect by means of air pressure as described below.

Since the bobbin or tubular package core when rotating on the cushion of air or gas is not restrained from lateral motion, the bobbin could work off the elongated chuck body and cause considerable harm or damage. It is a requirement, therefore, that a lateral restraint (in the form of retaining end segments) which can include a stop or guide at each end of the bobbin, is necessary when the chuck is used in a horizontal operation. The lateral restraint may not be necessary if the chuck is used in a vertical operation. Since bobbins can have variable lengths, the retaining end segments should be adjustable in order to confine as closely as possible the bobbin within the retaining end segments to avoid excessive oscillation between stops producing a poor package build of the yarn product. The bobbin length variation determines the need for adjustability of the retaining end segments. A modification can be incorporated here to combine the retaining end segments and the air flow limit in the form of a mechanical seal with the bobbin edge being the rotating member of the seal.

For the non-rotating chuck of this invention to function under the loading of the rotating bobbin and yarn package, it is essential for the bobbin to become eccentric to the elongated chuck body and for the air pressure to become non-uniform around the circumference of the elongated chuck body. Under these conditions, a difference in radial pressure is established which carries the load. Since the pressure is a function of the flow of gas or air and the clearance between the bobbin and the elongated chuck body as well as the supply system, the flow of gas or air from the elongated chuck body must be controlled or limited. This can be accomplished by utilizing constant flow devices such as pumps or valves or by flow limiting devices such as orifices, nozzles, or capillary restrictors. In any event, the essentially constant flow of air or gas from that part of the elongated chuck body with a small clearance between the inner surface of the bobbin and the outer surface of the elongated chuck body faces a high resistance to flow, producing a high pressure and forcing the bobbin toward a concentric positions. On the other hand, an essentially constant flow of air or gas from that part of the elongated chuck body with a large clearance between the inner surface of the bobbin and the outer surface of the elongated chuck body faces a low resistance to flow, produces a lower pressure and allows the opposing high pressure to force the bobbin towards a concentric position.

The over-all principle of this invention proposes an apparatus which does not have any unbalanced forces to produce wear on the chuck. It is of significance that, under these conditions, the maintenance of the chuck is kept to a minimum. Under these same conditions, the tolerances of the inner diameters of the bobbins and the

outer surfaces of the elongated chuck body are of no substantial consequence since the air or gas compensates for any variable differences.

To further clarify the invention, reference is made to the accompanying drawings wherein FIGURES 1 and 2 represent plan end views of two different types of non-rotating chucks as comprehended by the present invention.

FIGURE 1 is a plan end view of a non-rotating windup chuck expandable and retractable by mechanical means.

FIGURE 2 is a plan end view of a non-rotating windup chuck expandable and retractable by air pressure.

FIGURE 1 represents a non-rotatable chuck where the sides of the elongated chuck body can be mechanically expanded and contracted to more closely fit the inner diameter of the bobbin. FIGURE 1 represents a four pad or unit, adjustable chuck wherein a bobbin tube **1** is slipped over the small end of the elongated chuck body **2** and pressed against the adjustable stop **11**. Movable shaft **3** is rotated in the threaded mounting **4** and drives the end taper **5** which moves the four segments **6** radially to function as retaining end segments or stops to prevent bobbin **1** lateral motion. Further rotation of shaft **3** moves tapers **7** into contact with balls **8** and moves these balls into the four adjustable pressure pads **9** (three partially shown in the drawing) which expand toward the bobbin inside diameter. The supporting cylinder **10** provides the base of support for the moving action and acts as the case for the adjusting balls **8**. The adjustment of shaft **3** is stopped when the desired elongated chuck body diameter is obtained. Air is supplied to each of the four units through a supply means **12** (4 holes or ports) to the openings or ports **13**.

FIGURE 2 represents a somewhat modified version of FIGURE 1 where the retractable and expandable sides of the elongated body chuck are controlled by air pressure. FIGURE 2 also represents a four pad or unit, adjustable chuck wherein the elongated chuck body **14** is mounted by hollow tube **15** as the air supply to operate the chuck. The bobbin tube **16** is slipped over the small end of the chuck **14** and held against the adjustable stop **17**. The air supply to the tube **15** is energized and segment piston **18** moves forward and expands the end retaining segments **19** with the end segment adjusting cone **20**. This prevents bobbin **16** from moving laterally. Air going through ports or openings **21** acts pistons **22** causing them to move laterally against the internal tapers on pressure pads **23**. This causes the pressure pads **23** (four in total) to move radially outwards towards the bobbin **16** inside diameter. Air is also admitted to each pressure pad segment **23** through the supply openings or ports **24** (four in total) by a suitable restrictor or control; not shown, and creates the air bearing cushion which supports the bobbin **16**. The pressure pads **23** come to a desired equilibrium position which creates a desired bobbin to the elongated chuck body **14** clearance by proper selection of pressure in tube **15** and proper sizing of return springs **26**. The air supported bobbin **16** is then placed against a rotating drive roll or other driving means, not shown, and yarn is wound up using a suitable traverse (not shown). After the yarn has been placed on the bobbin, the driving means is removed, the bobbin is stopped by methods not shown. The air pressure is released from tube **15**, return spring **26** and **27** retract pressure pads **23**, pistons **22** and retaining end segment piston **18** allowing the bobbin of yarn to be removed. It

is apparent that other changes and modifications may be made in the disclosed non-rotating wind-up chuck without departing from the spirit of the present invention which is therefore intended to be limited only by the scope of the appended claims.

What is claimed is:

1. A non-rotating windup chuck comprising an elongated chuck body having expansible and retractable sides and having at least one opening in its surface, and said elongated chuck body adapted to receive and maintain a tubular package core in a set position relative to said elongated chuck body and means to supply said openings in said elongated chuck body with gas under pressure for purposes of contacting the inner surface of a tubular package core when placed over said elongated chuck body in a manner to provide sufficient pressure to separate said tubular package core from the elongated chuck body and permit rotation of said tubular package core on a cushion of gas around said elongated body.

2. A non-rotating windup chuck comprising an elongated chuck body having expansible and retractable sides and having at least one opening in the surface of said elongated chuck body, said elongated chuck body adapted to receive a tubular package core having a substantially cylindrical inner surface which is fitted to the outer surface of said elongated chuck body having the expansible and retractable sides, retaining end segments on said elongated chuck body to maintain a tubular package core in the same relative position to said elongated chuck body when said tubular package core is placed over said elongated chuck body and means to supply said openings in the surfaces of said elongated chuck body with air under pressure for purposes of contacting the inner surface of said tubular package core when placed over said elongated chuck body in a manner to provide sufficient pressure to separate said tubular package core from said elongated chuck body and permit rotation of said tubular package core on a cushion of air around said elongated chuck body.

3. A non-rotating windup chuck comprising an elongated chuck body having expansible and retractable sides and having a plurality of openings in the surface of said elongated chuck body, said elongated chuck body adapted to receive a tubular package core having a substantially cylindrical inner surface which is fitted to the outer surface of said elongated chuck body having the expansible and retractable sides, retaining end segments on said elongated chuck body to maintain a tubular package core in the same relative position to said elongated chuck body when said tubular package core is placed over said elongated chuck body and means to supply said openings in the surfaces of said elongated chuck body with air under pressure for purposes of contacting the inner surface of said tubular package core when placed over said elongated chuck body in a manner to provide sufficient pressure to separate said tubular package core from said elongated chuck body and permit rotation of said tubular package core on a cushion of air around said elongated chuck body.

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