July 23, 1957 E. C. STEINBACH 2,800,332

EXPANDING MANDREL FOR RECORDING BELT

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Fig. 1.

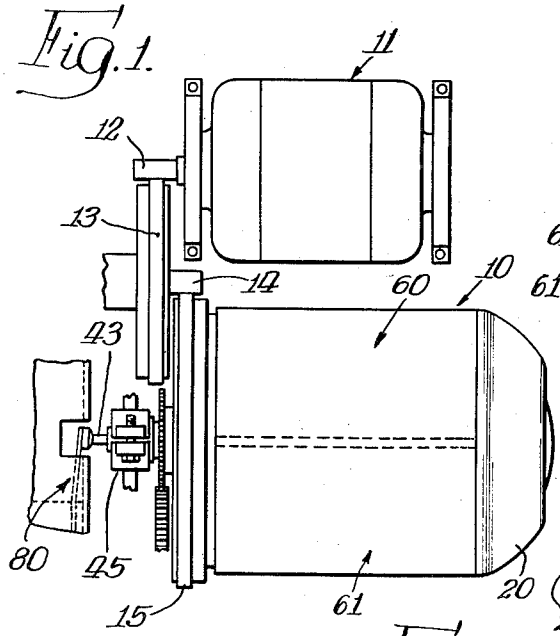


Fig. 5.

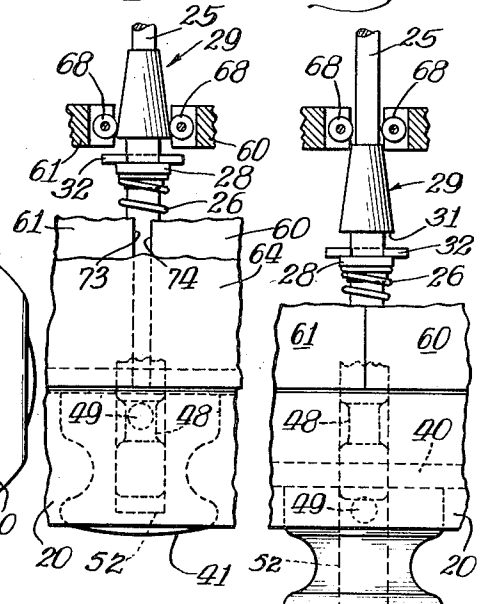
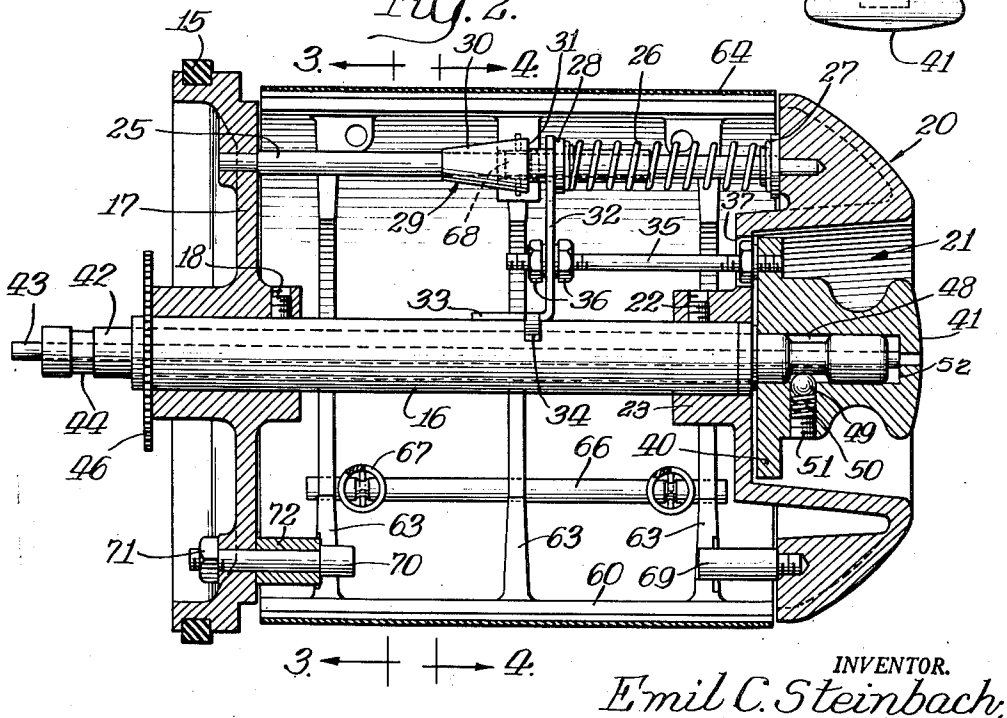


Fig. 6.

Fig. 2.



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Fig. 3.

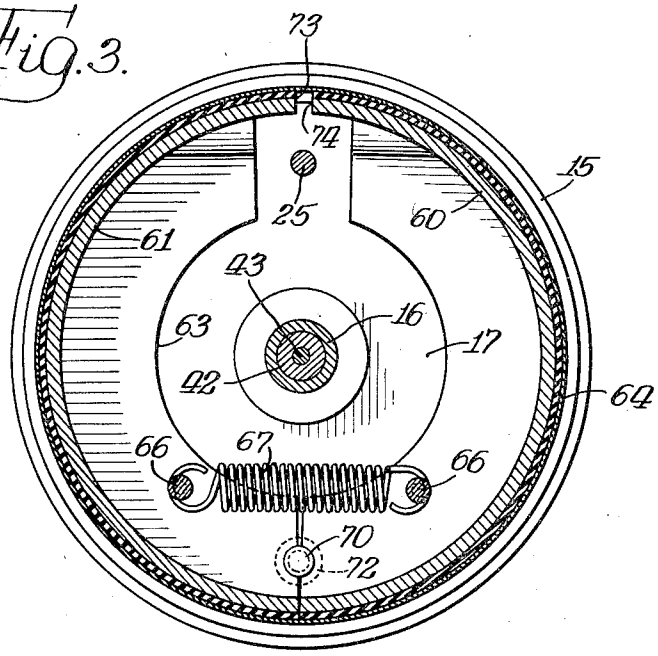
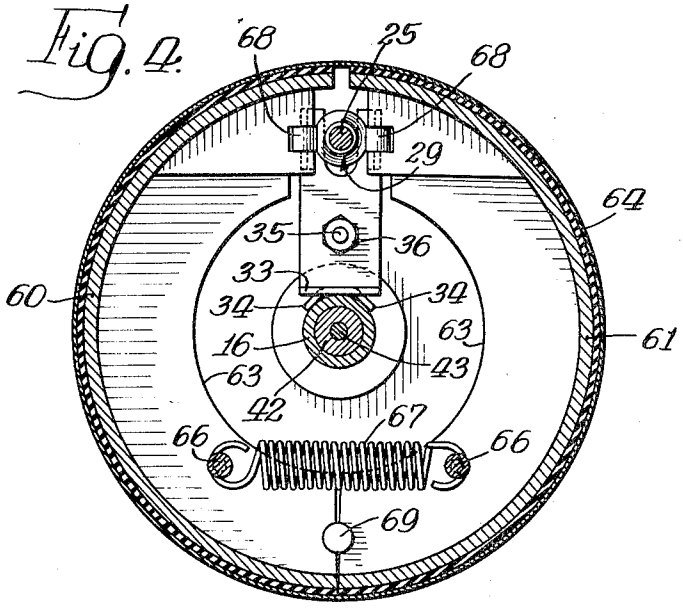


Fig. 4.



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2,800,332

EXPANDING MANDREL FOR RECORDING BELT

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Application April 21, 1954, Serial No. 424,720

6 Claims. (Cl. 274—40)

This invention relates generally to tape recorders and more specifically to a new and improved tape recorder of the belt variety with the particular subject matter of the instant application concerning an improvement in expanding mandrel means for mounting and holding a belt style of magnetic recording tape.

Recent developments in dictation equipment have led to compact and improved belt recorders, particularly belt recorders using wax coated belts as in the "Dictaphone" machine.

My present contribution to the art concerns a new and improved mandrel mechanism for mounting and holding a magnetic tape constructed as a closed belt for use in a tape recording or dictating machine. Briefly, I contemplate the provision of a substantially cylindrical mandrel member having means moveable axially thereof for causing radial expansion and contraction of a substantially cylindrical surface portion of the mandrel whereby a closed loop belt may be placed on the mandrel, the mandrel expanded to an outward radial limit and the belt firmly held on the mandrel for recording purposes. Such mandrel is also radially contractable for removal of the belt at the termination of its recording period. The mode of operation and function of this improved mandrel is simple and direct, embodying uncomplicated mechanisms and arrangements of parts which will be readily recognized by those familiar with the art. There are however, certain features and functions of my device which I believe mark the same as an advancement and improvement in this particular art, as will be set forth presently.

The main object of this invention is to provide a new and improved expansible mandrel means for use in a belt type magnetic tape recorder.

A further object of this invention is to provide a new and improved expansible mandrel means for holding tape recording belts in which simplified structure and arrangements of elements are employed to provide a simplified and directly acting mechanism capable of a desired radial expansion or contraction to tension or release a closed loop recording belt.

It is also an object of this invention to provide a simplified and improved means in conjunction with the mandrel expansion and contraction mechanism whereby the energization of power means for rotating the mandrel may be selectively initiated and terminated in accordance with the expanding and contracting movements of the mandrel.

The above and further objects, features and advantages of this device will be recognized by those familiar with the art from the following detailed description and specifications therefor and particularly with regard to the illustration of a preferred embodiment of its concepts as found in the accompanying drawings.

In the drawings:

Figure 1 is a top plan view showing a partial lay-out of a particularly preferred mode for rotatably driving the mandrel of this invention and relating the same to a switch system for controlling energization and deenergization of the drive means for the mandrel;

Figure 2 is a longitudinal sectional view taken substantially at the longitudinal center line of the improved mandrel of my invention showing the working arrangement of the several elements therein;

Figure 3 is a transverse cross-sectional view of the mandrel illustrated in Figure 2 taken substantially at line 3—3 of Figure 2;

Figure 4 is a cross-sectional view similar to Figure 3, but taken at line 4—4 of Figure 2 and looking in the opposite direction as indicated by the arrows on line 4—4;

Figure 5 is a partial enlarged plan view illustrating the means for expanding the mandrel of this invention; and

Figure 6 is a partial enlarged view similar in all respects to Figure 5, but illustrating the mode and means for radially contracting the mandrel of this invention.

Turning now to the features and concepts of my improvements which are of subject herein, as related to its preferred form shown in the accompanying drawings, it will be understood that the improved mandrel of my invention, indicated generally and in its entirety by numeral **10** in Figure 1, is to be used in conjunction with a drive motor means **11** having an armature shaft **12**. A friction wheel **13** is mounted on an intermediate drive shaft **14** adjacent armature shaft **12**, as illustrated. The particular power drive connection to the mandrel of this invention is of minor importance as long as some means is provided for rotatably driving the same to advance a loop style of tape recording belt beneath a recording head or stylus of the dictation machine. As shown, however, the drive means employed comprises the frictional disc or plate **13** on the intermediate drive shaft **14**, such being rotatably driven by armature shaft **12** of the motor **11**. Shaft **14** in turn engages an annular friction ring **15** mounted about one end of the mandrel and comprising a friction surface thereon.

Turning now specifically to the features of construction in the improved mandrel means of this invention, reference should be had to Figures 2, 3 and 4 of the drawings especially since it is believed that these figures best illustrate the concepts of my invention as embodied in the preferred form illustrated. It will be recognized that by and large the entire mandrel structure is built about a hollow hub shaft or core member **16** which supports a circular drive flange member **17** at one end. Flange member **17** has the friction drive ring **15** fixed about its outer periphery in a suitable indented recess or annular groove formed for that purpose. A locking screw means **18** is utilized to connect the flange member **17** to the hub shaft **16**. At the opposite end of shaft **16**, a secondary flange member **20** is provided, the same having a curvilinear axial indentation in its makeup so as to provide an inward depression or cup portion **21** at its outer end. A lock screw means **22** is used for joining a hub portion **23** of the flange member **20** to the shaft **16**, similar to the attachment of flange **17** to the same shaft.

Extending between the two flange members **17** and **20**, and adjacent the outer periphery thereof is a guide shaft member **25**. Such shaft **25** supports a spring means **26** thereon, which abuts at its opposite ends a locating washer member **27** adjacent flange **20**, and a similar boss portion **28** arranged for sliding motion on shaft **25** and connectedly related to and formed integrally with a shifting sleeve **29**. Sleeve **29**, is distinguished by a frusto-conical surface or portion **30** adjacent one end, which comprises a shifting system for the mandrel surfaces as will be explained hereinafter.

Adjacent the frustro-conical portion **30** of the sleeve **29** is formed an annular indentation or recess **31** which receives a yoke or forked end of a shifting arm member **32**, the latter extending downwardly to the hollow hub shaft **16** and having a lower platform portion **33** provided

with depending ear elements 34 at opposite lateral extremes thereof. Such ears and platform 33 serve as a guide means for permitting the shifting arm 32 to slidingly move along the external surface of shaft 16. Means for shifting member 32 along shaft 16, comprises a tie bolt member 35 having a pair of adjusting nuts 36—36 at one end which connect bolt 35 to the shifting arm 32. The opposite end of bolt 35 extends through an enlarged opening 37 formed in the bottom wall of the cup or indented recess portion 21 of flange 20. Such bolt member 35 is threadingly joined to a circular flange portion 40 of an operating knob member 41 mounted in cup 21. Knob 41 is supported on, but disposed for sliding movement relative to an internal quill shaft 42 mounted coaxially within shaft 16 and projecting into cup portion 21. It will be understood that shifting of handle 41 serves to correspondingly shift arm 32 causing a resilient compression of spring 16 and a corresponding shifting of the conical surface 30 of the shift sleeve 29.

Shaft 42 is provided with a hollow axial opening in which is slidingly fitted a solid quill rod member 43 having greater length than shaft 42. Shaft 42 is also provided with an indented annular recess at one end, labelled generally at 44, the same being adjacent the opposite end of shaft 42 from the operating handle or knob member 41. This recess 44 is provided for locking engagement with a supporting collar structure 45 connected to the chassis of the dictating machine. Locking of the collar structure 45 with shaft 44 of course prevents rotation of the latter shaft, but permits rotation of the hollow core shaft 16 thereabout. Also movement of the quill rod member 43 axially of shaft 42 is permitted, all of which will be amplified in greater detail presently. Axial displacement of the flanges 17 and 20 and related structure supported on the hollow shaft 16 is prevented by operating knob 41 and a take-off spur gear 46 located adjacently outward of flange 17. Shaft 42 is also provided with another recess or annular indentation 48 which is normally disposed within the operating knob 41. Such recess 48 is designed to receive a detent ball member 49 biased inwardly toward shaft 42 by spring means 50 compressibly adjusted by a plug screw means 51, all held in a suitable bore for that purpose formed through the side walls of operating knob 41.

The detent structure comprising ball 49, spring 50 and plug 51, serves two purposes, namely, that of holding the operating knob 41 and attached sleeve member 29 inwardly or that is in the position illustrated in Figure 5 and secondly to hold the same structure at an outer limit of axial displacement as illustrated in Figure 6. With particular regard to this last position of operation, it will be noted that when the operating knob is at its axially outwardmost limit, the ball 49 locates itself between the end of the stationary shaft 42 and the end of hollow bore 52 within operating knob 41.

Turning now to Figures 2, 3 and 4 of the drawings it will be recognized that the structure heretofore described and specifically the two flange members 17 and 29 thereof, is designed to support a pair of half shell segments 60 and 61 comprising the cylindrical exterior surface for the mandrel. Such segments are identical in formation and each comprise a suitable dielectric material, for example Bakelite or like plastic. Internal transverse reinforcing webs 63 are provided in each one of the half shells or segments, the same being spaced at intervals along the axial length of the shells and aligned in coplanar pairs when the segments are mounted about the flanges 17 and 20. The external surface of each shell or segment is provided with a suitable coating of rubber or the like, as at 64 (see Figures 3 and 4). Each of the half shells carries adjacent its lower side, as illustrated in Figure 2, a retaining rod member 66 having indentations adjacent its opposite ends for the retention of two tension spring members 67, 67. The rods pass through the several webs 63 of the segments and are disposed in spaced parallelism such that springs 67 may be tensioned between the opposed half segments, as illustrated best in Figures 3 and 4 of the drawings. It will be recognized that the webs 63—63 are cut away to accommodate the passage of shaft 25 and the related assembly thereon. The middle one of the three webs 63 is provided with a pair of opposed rollers 68, 68 one mounted on each of the half segments. Such rollers reside adjacent the passageway or space between the two shell segments in which shaft 25 is located so that the same can engage the conical surface 30 of the shifting sleeve 29. Means for locating the two half segments in operative position and between the two flange members 17 and 20 comprise a short stud post 69 projecting from the inside face of flange member 20 and an extending locating pin 70 held to flange 17 as by bolt means 71 and a spacer collar 72. Each of the endwise web members 63 of each shell is suitably cut away to accommodate the reception of the locating pin 70 and member 69. It will be noted that stud 69 and locating pin 70 are coaxially aligned and form a pair of pivot centers or a common pivot axis for pivotal motion of the two segments 60 and 61 thereabout.

Mounting of the segments is carried forth simply by opening the same against the biasing force of the spring members 67—67 and slipping the same over the locating stud 69 and pin 70 whereafter springs 67 will cause the same to assume a substantially cylindrical contour concentrically about the hollow hub shaft 16, substantially as illustrated in Figures 1 and 2 of the drawings. The two half shells or segments are unconnected entirely along one side, as at edges 73 and 74 thereof, and when the two half segments are mounted over flange members 17 and 20, the rollers 68 thereon engage the frustro-conical surface 30 of the slide sleeve 29.

This latter relation may be better understood by reference to Figures 5 and 6 of the drawings. From these latter two named figures it will also be recognized that when the operating knob 41 is pushed inwardly, as in Figure 5, the larger diameter of the frustro-conical surface portion 30 of member 29 serves to bias the two half shell members 60 and 61 apart against the biasing efforts of springs 67 a distance defined by the base diameter of the frustro-conical portion 30. Conversely, retraction of operating knob 41 to its outermost position as illustrated in Figure 6, permits the two half segments to move toward one another under the influence of springs 67; rollers 68 following the decreasing diameter and contour of the frustro-conical portion 30, during this operation.

From the above description it will be understood that the in and out motion of the operating knob 41 causes axial displacement of the frustro-conical actuator 29 and results in the radial expansion or contraction, as the case may be, of the external cylindrical surface of the mandrel. This expansion and contraction function is carried forth by moving the two half shell segments 60 and 61 relative to one another about a substantially horizontal axis located adjacent their lower ends and defined by members 69, 70. It is further to be regarded that while I have herein described the segment members 60 and 61 as being substantially semi-cylindrical, the separation of edges 73 and 74 thereof, is sufficient so that when the same are in their radially outermost expanded condition, as illustrated in Figure 4, the external surface presented thereby it is that of a true cylinder for the reception of a suitable recording belt as desired.

It should also be noted that in and out shifting of the knob 41 causes like motion of quill rod 43. Since this rod is arranged to contact an on and off plunger type switch assembly 80, movement of the knob 41 in accordance with the loading and unloading of a recording belt on the mandrel, also causes automatic energization and deenergization of motor 11 which is in circuit with switch 80. Thus an automatic means for interrupting rotational driving of the mandrel is provided.

Thus it will be seen, that I have herein shown and described the concepts and features of a preferred form of my invention for an improved expansion type mandrel to be utilized particularly in a belt type of tape recorder, using a continuous belt or sleeve style of recording medium. Further, while I have described my invention as related to a single preferred form thereof, as illustrated in the drawings, it will be understood and appreciated that numerous changes, modifications and substitutions of equivalents may be resorted to in carrying out its principles without necessarily departing from the spirit and scope of its inventive features. As a consequence, I do not wish to be limited to the particular form and embodiment of my invention herein illustrated and described, except as may appear in the following appended claims.

I claim:

1. A mandrel means for a tape recorder of the class described, comprising, a shaft member, a pair of substantially cylindrical flange members mounted adjacent opposite ends of said shaft member, a pair of semi-cylindrical shell members mounted about said shaft member and extending between said flange members, pin means carried by said flange members for pivotally supporting said shell members such that the same are moveable with respect to one another about an axis disposed in spaced parallelism to said shaft, yielding means normally biasing said shell members toward one another, a rod member extending between said flange members in spaced parallelism to said shaft member, a sleeve means having a conical surface mounted for rectilinear reciprocation along said rod member, opposed roller members carried by said shell members so that such have rolling engagement with the conical surface of said sleeve member, and means for shifting said sleeve member rectilinearly such that the shell members are moved between radial limits as said conical surface is moved past said opposed rollers.

2. A mandrel means for holding a belt type of tape in a magnetic recorder of the class described, comprising in combination, central shaft means, a pair of substantially circular flange members mounted adjacent opposite ends of said shaft means, a pair of substantially semi-cylindrical shell elements mounted about said shaft means, spring means extending between said shell members transversely of the axis of said shaft means for normally biasing said shell members together, coaxial pivot means carried by said flange members for supporting said shell members to move pivotally about an axis disposed in spaced parallelism to the longitudinal axis of said shaft means, rod means extending between said flange means in spaced parallelism to said shaft means and on the opposite side of the latter means from said pivot means, a sleeve member slidingly mounted on said rod member and having a frusto-conical portion at one end, a pair of opposed roller members, carried one on each of said shell members in rolling engagement with the said frusto-conical portion of said sleeve member, and means for rectilinearly shifting said sleeve member; shifting movement of said sleeve member serving to pivotally move said shell members toward and away from one another so as to cause substantially a radial contraction and expansion of the cylindrical surface presented thereby.

3. In a tape recorder of the class described, an improved mandrel means for supporting a belt type of recording tape, comprising, a hollow shaft means, a pair of flange members mounted adjacent opposite ends of said shaft means, a pair of coaxial pivot members mounted one on each of said flange members, a rod member extending between said flange members in longitudinal parallelism with said shaft member; said rod member and pivot members being disposed on opposite sides of said shaft member, a pair of substantially semi-cylindrical shell members mounted about said shaft member and extending between said flange members, said shell members being pivotally supported on said pivot means, spring means normally biasing said shell members toward one another, a sleeve member mounted for sliding movement on said rod member and having a conical cam surface adjacent one end thereof, roller means carried by said shell members for engaging the said frustro-conical surface of said sleeve member, manually operable knob means for selectively shifting said sleeve member between limits, and detent means for arresting said sleeve member at predetermined limits of its reciprocal movement; said shell members being moved pivotally toward and away from one another in response to the movements of said frustro-conical surface past said roller members.

4. Mandrel means for supporting a closed loop style of magnetic recording belt, comprising, a shaft means, a pair of flange members, substantially circular in contour, mounted fixedly on opposite ends of said shaft means, a pair of semi-cylindrical shell members mounted about said shaft means and extending between said two flange members, a pair of coaxially aligned pivot pin members, one associated with each of said flange members for pivotally supporting said two shell members on an axis located in spaced parallelism to the longitudinal axis of said shaft member, rib means internally reinforcing said shell members, a pair of roller members carried one by each of said shell members on said rib means thereof, a rod member extending between said two flange members, a sleeve member slidingly mounted on said rod member and having a frustro-conical portion formed at one end thereof, said frustro-conical portion normally engaging said roller members, spring means tensioned between said shell members in a direction related transversely of said shaft member, said spring means being located intermediate the pivotal axis for said shell members and said shaft member, an operating knob means slidable on said shaft member and having connection means for shifting said sleeve member relative to said roller members; the movement of said sleeve member causing the frustro-conical portion thereon to cause the movement of said shell members toward and away from one another with the spacing between said shell members being regulated by the diameter of said frustro-conical portion at its plane of contact with said roller members whereby a mandrel means is provided capable of substantially radial contraction and expansion between selected limits as dictated by the minor and major diameters of the frustro-conical portion of said sleeve.

5. For use in a tape recorder of the type employing a closed loop type of recording belt, a mandrel means for holding such a belt, comprising, a shaft means, circular flange members supported adjacent opposite ends of said shaft means, a pair of pivot members carried in coaxial alignment, one on each of said flange members and adjacent the periphery thereof, a sleeve member having a frustro-conical tapered portion, a rod means supporting said sleeve member for rectilinear reciprocation between said flange members, knob means available exteriorly of said flange members for shifting said sleeve member between limits, detent means for arresting said sleeve member at predetermined limits, a pair of substantially semi-cylindrical shell members mounted substantially concentrically about said shaft means and supported on said pivot members for limited pivotal movement on the axis defined thereby, and spring means interconnecting said shell members for biasing the same into engagement with said sleeve member such that shifting of said sleeve causes pivotal movement of said shell members resulting in a diametrical alteration of the cylindrical surface presented thereby.

6. A mandrel means for supporting a closed loop style of magnetic recording belt and the like, comprising, a shaft means, a pair of flange members fixed at opposite ends of said shaft means, a pair of substantially semi-cylindrical half shell members mounted about said shaft means and extending between said flange members, an

operating knob member manually engageable exteriorally of one of said flange members and mounted coaxially of said shaft means for sliding movement relative thereto, coaxial pivot members on said flange members pivotally supporting said two shell members for movement about a common axis paralleling said shaft means and located adjacent the periphery of said flange members, and means having connection with said knob means for causing the pivotal shifting of said shell members relative to one another, thereby to cause a substantially radial contraction and expansion of the cylindrical surface presented by said shell members.

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