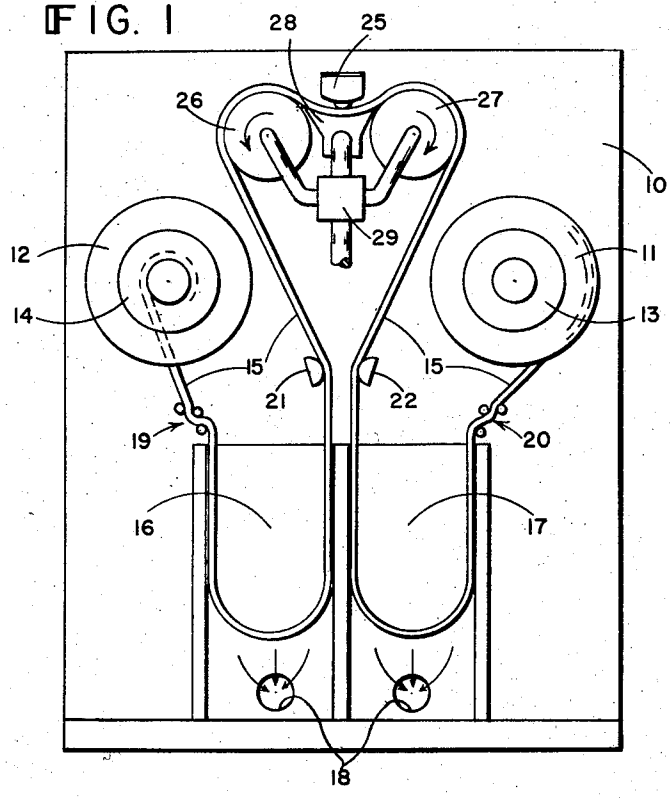
March 3, 1959 P. G. FORET ET AL 2,875,874

EXPANDABLE REEL MANDREL

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FIG. 1



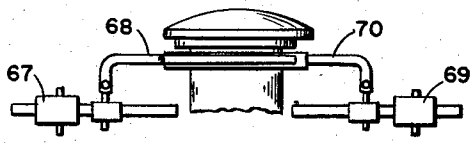


FIG. 7

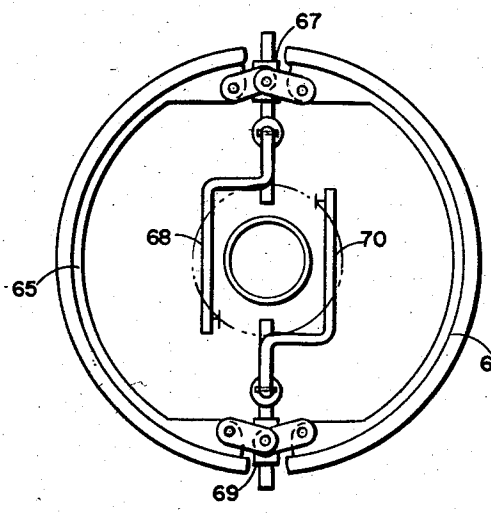


FIG. 6

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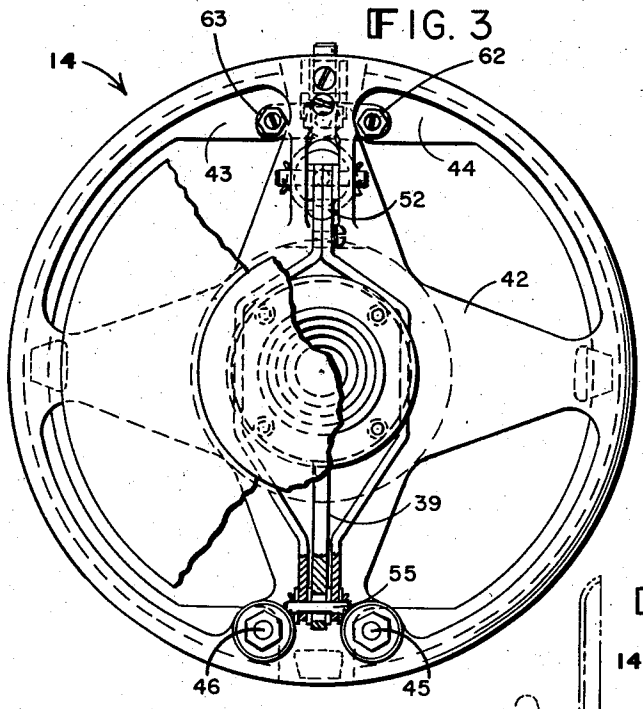
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EXPANDABLE REEL MANDREL

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FIG. 3



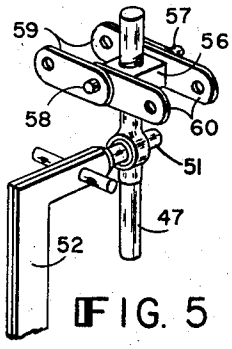


FIG. 5

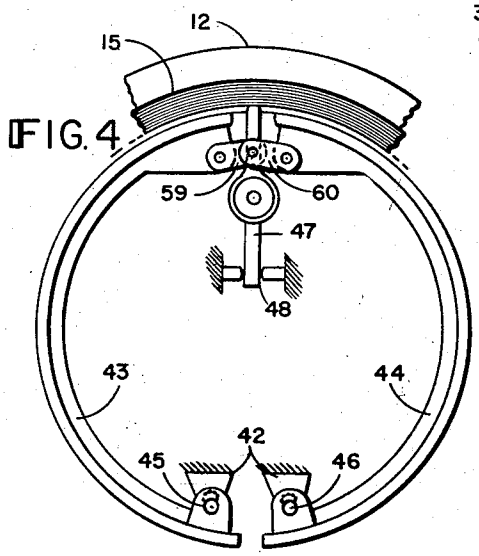


FIG. 4

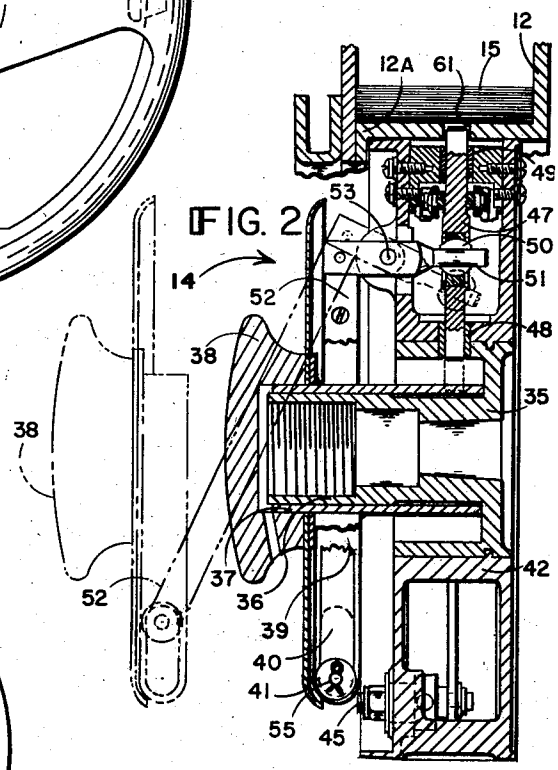


FIG. 2

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United States Patent Office 2,875,874 Patented Mar. 3, 1959

2,875,874

EXPANDABLE REEL MANDREL

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Application February 4, 1957, Serial No. 638,159

4 Claims. (Cl. 192—76)

A general object of the present invention is to provide a new and improved apparatus for mounting a reel which is adapted to be rotated. More specifically, the present invention is concerned with a new and improved reel mandrel which is characterized by its ability to carry a reel of considerable weight where the reel is repeatedly started and stopped in motion without any slippage of the reel upon the mandrel.

A known form of reel mounting mandrel comprises a pair of cylindrical clutch elements mounted about a driving axis of a mandrel where the clutch elements are adapted to be expanded into engagement with the inner surface of a reel which is to be carried thereby. The mounting of a heavy reel on a rotatable mandrel creates numerous problems particularly where the reel must be repeatedly started and stopped. In apparatus of the circumferential brake type heretofore available, the reel has been subject to slippage upon the mandrel causing resultant wear of the mandrel clutching surfaces and thereby considerably reducing the useful life of the mandrel and at the same time increasing the maintenance problems with respect thereto. If the slippage and wear associated with the mandrel go undetected, the operational hazards with respect to operating personnel and associated equipment may also be considerable. The provision of a greater clutching action on the mandrel by itself creates another problem that is inconsistent with the need for the reel to be readily removable from the mandrel with a minimum of effort on the part of the using personnel.

It is accordingly a more specific object of the present invention to provide a new and improved rotatable mandrel which is adapted to carry a reel where the mandrel is to be started and stopped repeatedly with means for insuring a firm locking relationship between the reel and the mandrel in combination with means for readily activating the clutching surfaces of the mandrel and releasing the clutching surfaces to permit an operator to firmly lock the associated reel on the mandrel and readily remove the reel therefrom.

The foregoing object of the present invention is achieved by a new and novel combination of linkage means and levers so arranged that a simple mechanical motion on the part of an operator will be effective to move a pair of clutching braking surfaces carried by the mandrel into a locking position where the links associated with the clutch are toggled to thereby lock the brake shoes on the mandrel. In addition, a driving link for the toggle is provided whereby the toggle may be moved into and out of the locking position with a minimum of effort on the part of an operator.

It is therefore a still further more specific object of the present invention to provide a new and improved mandrel which is arranged to detachably support a reel to be rotated where the mandrel has a very high gripping action on the inner surface of the reel with this gripping action being imparted thereto by a new and novel linkage actuating a clutch driving toggle which may be

actuated by a minimum of effort on the part of an operator.

This new and novel linkage is arranged with respect to the mandrel so that the linkage may be moved in such a way that it does not interfere with an operator placing a reel on the mandrel or removing a reel therefrom.

A further requirement of some forms of apparatus of the present type is that a positive mechanical lock be provided for the reel in addition to the normal clutching action applied thereto by the reel mandrel. This has been accomplished in the present invention by means of extending the link which drives the clutch actuating toggle so that the link may project into the rim of the associated reel and thereby positively lock the reel in position while the toggle is holding the clutch members of the mandrel in the active clutching position.

It is then a still further object of the invention to provide a new and improved reel mandrel in accordance with the foregoing objects wherein a clutch actuating toggle drive link is extended so that it may be used to positively engage a reel mounted on the mandrel.

The foregoing objects and features of novelty which characterize the invention as well as other objects of the invention are pointed out with particularity in the claims annexed to and forming a part of the specification. For a better understanding of the invention, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

Of the drawings:

Figure 1 is a diagrammatic showing of an apparatus which is adapted to use the reel mandrel of the present invention;

Figure 2 shows a sectional side view of the reel mandrel of the present invention;

Figure 3 shows a top plan view of the reel mandrel shown in Figure 2;

Figure 4 is a diagrammatic showing of the clutch shoes and the toggle actuating means for the clutches in combination with the toggle drive link;

Figure 5 shows a perspective view of the toggle linkage for the clutch assembly of Figure 4 with a portion of the driving lever for the toggle drive link also shown;

Figure 6 is a diagrammatic showing of how the principles of the present invention may be extended to a double toggle clutch actuating mechanism; and

Figure 7 shows a side view of the actuating levers and the toggle drive linkages for apparatus of the type shown in Figure 6.

Referring first to Figure 1, the numeral **10** represents a panel or support upon which are mounted elements associated with a record tape transport mechanism useful, for example, in the storing of information on the tape utilized therein. Carried by the support **10** are a pair of tape supply reels **11** and **12** which are adapted to be reversibly driven by support mandrels **13** and **14**, respectively, by motor means, not shown, but supported on the reverse side of the panel **10**. The reels **11** and **12** are adapted to carry a tape **15** which may take the form of a magnetic tape upon which information may be stored by electrical impulses. The tape **15** is arranged to pass through a pair of loop chambers **16** and **17**, said loop chambers being arranged to maintain the tape **15** under tension due to the action of the atmospheric pressure exerted on the top of the tape and the reduced pressure created under the tape in the loop chamber by a suitable suction means connected to the outlet conduits **18**.

The tape **15** is guided into the loop chambers **16** and **17** by suitable guide and tensioning pins **19** and **20** as well as by the guide pins **21** and **22**. The guide pins **19** and **20**, together with the force on the tape due to the

pressure in the loop chamber, function to maintain the tape **15** under tension as it is fed onto the respective reels **11** and **12**. This prevents the tape from forming pockets and bulging as it is wound on the reel **11** or **12**.

A suitable informational transfer head **25** is positioned to engage the tape **15**, the latter of which is moved past the transfer head by a pair of contra-rotating capstans **26** and **27** which are of the pneumatic type. Positioned between the capstans **26** and **27** is a pneumatic brake **28**. The sudden application of a reduced pressure to either of the capstans **26** or **27** or the brake **28** is used to selectively control the movement or stopping of the tape **15** with respect to the transfer head **25**. The controlling of the pressure supplied to the capstans and the brake is by way of a suitable pneumatic switching means **29**.

In considering the operation of the apparatus shown in Figure 1, it should first be noted that, whether for tape recording or reading purposes, it is desired to move the tape **15** past the information transfer head **25**. The movement of the tape must be at some predetermined speed which is suitable for producing a transfer of information between the head and the tape. Such a speed may be, for example, one hundred inches per second and the capstan diameter and rotational speed are so selected as to produce this linear surface speed. The driving of the tape **15** past the head is accomplished by either one or the other of the driving capstans **26** and **27**. If it is desired to drive the tape from left to right past the reading head **25**, the capstan **27** is actuated by the pneumatic switch **29** so that a subatmospheric pressure is applied to the capstan **27** to result in the tape being drawn into engagement with the capstan so that the rotation is transferred to the tape when it is moved in the desired direction. Should it be desired to move the tape in the opposite direction, the capstan **26** will be actuated by the application of a subatmospheric pressure thereto by the switch **29** and this will cause the tape to be drawn against the capstan **26** so that the tape will be moved in the desired direction.

When it is desired to stop the tape, the pneumatic switch **29** is effective to disconnect the subatmospheric pressure from the capstan previously driven and apply the pressure to the brake **28**. The brake member will in turn draw the tape against the face of the brake and cause the tape to stop.

For a more detailed consideration of the capstan and brake assembly illustrated in Figure 1, reference should be had to the co-pending application of Robert A. Pendleton entitled "Control Apparatus" bearing Serial Number 586,209, filed May 21, 1956.

The tape reels **11** and **12** are arranged to be driven by motor means, not shown, to maintain the desired amount of tape within the loop chambers **16** and **17**. The depth of the tape in the respective loop chamber may be detected by suitable photoelectric means, or pressure sensing means. When the tape is being driven from left to right, the tape **15** will tend to fill up the chamber **17**. As the tape extends further into the chamber **17**, the reel **11** must be operated to pull a suitable length of tape out of the chamber onto the reel. Inasmuch as the effective diameter of the reel will vary with the amount of tape thereon, it will be apparent that the reel **11** can not be driven at a uniform speed in order to remove the tape **15** from the chamber **17**. Consequently, the reel **11** must be repeatedly stopped and started in order to take up the tape from the loop chamber. It will be apparent that with respect to the chamber **16** when the tape is being driven by the capstan **26**, the reel **12** must be used to take up the excess tape from the chamber. For the reasons set forth with respect to the reel **11**, the reel **12** must also be driven at periodic intervals as it is not practical to maintain a varying speed on the tape reel in order to compensate for variations in the effective diameter of the reel due to the amount of tape thereon. It will be apparent that the reels **11** and **12** must also be driven to supply tape to the loop chambers **16** and **17** to maintain a desired amount of slack tape on either side of the driving capstans. This too necessitates repeated starting and stopping of the active feed reel.

From the foregoing discussion of Figure 1, it will be apparent that the reels **11** and **12** are periodically stopped and started and also driven in a forward or reverse direction. In one particular embodiment of the present invention, the reels **11** and **12** utilized an inner hub which was ten inches in diameter and the rell itself, when fully loaded with magnetic tape weighed approximately twenty-two pounds. It will thus be appreciated that the torque exerted on the reel by the drive mandrels associated therewith during this repeated starting and stopping is extremely high. The resultant high accelerations and decelerations require a very effective mandrel which will grip the reel to prevent any slippage of the reel on the mandrel. Further, the reels of the apparatus must be adapted for ready removal to permit an operator to change reels without undue effort or delay.

Considering now the reel mandrel more specifically and noting particularly Figures 2 through 5, it will be seen that the mandrel comprises a basic drive hub for the mandrel **14**, as shown in Figure 2, which comprises a cast member **35** suitably drilled and threaded so that it may be readily attached and locked to a drive shaft, not shown. The hub **35** has a cylindrical portion **36** upon which is supported a cylindrical member **37**, the latter of which is adapted for axial displacement by means of a handle **38**. The cylindrical member **37** carries a member **39**, which is slotted at **40**, and a protective cover plate **41**.

A reel guide and support plate **42** is mounted on the hub **35** and this support plate is arranged to carry the clutch members **43** and **44**, as shown best in Figure 4. The clutch members **43** and **44** are pivotly supported by a pair of eccentric pivot members **45** and **46**, the latter permitting the outward expansion of the clutch shoes or members **43** and **44** and in addition providing a means for aligning the shoes by the eccentric adjustment of the pivots. The clutch shoes have a **T** shaped cross section with the upright of the **T** section being sufficiently small enough to permit the shoes to be flexible to engage the associated reel over a wide surface.

Carried in the support member **42** on the side opposite the pivoting members **45** and **46** is a toggle drive link **47**, the latter of which is journaled in suitable bearing surfaces **48** and **49** for radial movement with respect to the drive axis of the mandrel. Carried by the toggle drive link **47** is a ball joint **50** having a pin **51** extending therethrough, the latter being an extension of a lever **52**. The lever **52** is pivoted at **53** and the opposite end is positioned in the slot **40** of the member **39**. It will be noted from the view in Figure 3 that the lever **52** is actually comprised of separate members which are split so as to pass around the hub **35** and then come back together again to a common pin **55**, the latter of which projects through the slot in the member **39**.

Carried by the toggle drive link **47** is a block **56**, the latter having a pair of pins **57** and **58** extending therefrom. The block **56** is threadedly mounted on the drive link **47** to provide an adjustment of the throw of the link **47** when the pin **51** extends through the drive link **47**, the relationship of the block **56** on the link **47** is locked. The pins **57** and **58** on block **56** are in turn used to act as pivots for the clutch toggle which comprises a pair of links **59** for clutch shoe **43** and a pair of links **60** for the clutch shoe **44**. The links **59** co-operate with a pivot pin **63** on clutch shoe **43** and the links **60** co-operate with a pivot pin **62** on clutch shoe **44**. The pins **62** and **63** may be eccentric for adjusting purposes.

The toggle drive link **47** may be arranged so that it extends into an aperature **61** in the inner rim of the reel **12** shown in partial cross section in Figure 2.

Considering the manner in which the mandrel **15** functions, the operator handle **38** may be moved to the left to the dotted line position shown in Figure 2. This will cause

the lever 52 to be moved in a clockwise direction about the pivot 53 to thereby cause the pin 51 extending from the lever 52 to move the toggle drive link 47 in an inward direction. This will cause the toggle links 59 and 60 to be moved in a downward direction and thereby move the clutch shoes 53 and 54 inwardly to an inactive position. The toggle drive link 47 will be withdrawn within the surface of the support 42. The mandrel is now ready to receive a reel such as a reel of tape shown at 12 in Figure 1 as well as in partial section in Figure 2.

The operator will place the reel upon the mandrel so that the reel surface 12A comes into engagement with the extension of the support member 42. It will be noted that the extension of the supporting member 42 has a slight taper to permit the ready placement of the reel on the mandrel. When the reel is in place, the operator merely depresses the handle 38 to the solid line position shown in Figure 2. This motion is effective to drive the lever 52 in a counter clockwise direction. This will in turn drive the toggle drive link 47 outward so that the toggle links 59 and 60 will force the clutching shoes 43 and 44 outward to engage the inner surface of the reel 12. This will lock the reel 12 on the mandrel. In addition, the outward extension of the drive link 47 may be arranged to extend into the aperture 61 in the reel 12 to provide a positive mechanical lock in addition to the clutching lock from the clutching shoes 43 and 44.

It will be apparent from the foregoing description that the present apparatus is capable of providing an extremely large clutching force upon the inner surface of the tape reel 12 due to the novel linkage arrangement which produces a very high mechanical advantage. The high mechanical advantage is achieved by the linkage which is arranged to in no way interfere with the operator placing a reel on the mandrel. This is due to the fact that the only mechanical movement is an axial movement of the handle 38 with respect to the drive hub 35, said movement not extending the linkage into the path of the reel as placed or removed from the mandrel. In one embodiment of the invention, a force of 3.5 pounds on the handle 38 was effective to produce a force of 182 pounds at the clutching surface. This force at the clutching surface permitted a torque of 32 foot pounds to be applied to the reel carried by the mandrel without any perceptible slippage of the reel on the mandrel as the reel was periodically stopped and started.

When the clutch toggle links 59 and 60 are moved to the active position as shown in Figure 4, the toggle links 59 and 60 will be slightly past center. Since they are slightly past center, they tend to exert an outward force on the drive link 47 and a force on the lever 52 which is in a counter clockwise direction. However, due to the fact that the cylindrical member 37 which carries the handle 38, is down against the inner portion of the hub 35, there is an effective lock on the clutch shoes with the lock being retained until the handle 38 is used to move the toggle back from its overcenter or locked position.

It will be readily apparent that the principles of the present invention may be expanded to include other types of mandrels. For example, the mandrel shown in Figure 6 in partial detail is an extension of the type of mechanism illustrated in Figures 2 through 4. Here, a toggle linkage is provided at both adjacent ends of a pair of clutch shoes 65 and 66. An upper toggle linkage 67 is arranged to be actuated by a lever 68 while a lower toggle linkage 69 is adapted to be activated by a lever 70. Levers 68 and 70 may well take the form of the lever 52 with one portion thereof extending around the central hub which carries the operating handle, such as the handle 38 shown in Figure 2. Each of the levers 68 and 70 may be arranged to engage a member carried by the handle which has been slotted as is the member 39 used to activate the lever 52 in Figure 2. It will be apparent that the levers 68 and 70 will be used to activate the toggle linkages 67 and 69 simultaneously. Further, this mechanism will provide a larger mechanical advantage to drive the clutching surfaces 65 and 66 from the inactive to the active position.

One embodiment of this modified version of the present invention achieved a mechanical advantage such that a force of 3.5 pounds on the handle produced a force of 300 pounds on the clutch members.

It will be apparent from the foregoing description that there has been provided a new and improved mandrel which is adapted to exert a high clutching and locking force upon the reel to be carried thereby and this clutching force may be achieved by a minimum effort on the part of the operator who places the reel upon the mandrel. It will further be apparent that the material selected for the clutch shoes and for the other materials must be selected to withstand the forces and pressures inherent in the particular application of the mandrel, and that various combinations of materials will be acceptable.

While, in accordance with the provisions of the statutes, there has been illustrated and described the best forms of the invention known, it will be apparent to those skilled in the art that changes may be made in the apparatus described without departing from the spirit of the invention defined by the claims and that in some cases, certain features of the invention may be used to advantage without a corresponding use of other features.

Having now described the invention, what is claimed as new and novel and for which it is desired to secure by Letters Patent is:

1. A reel mandrel comprising a pair of arcuate clutch members adapted to be radially expanded, a pair of links pivotally connected together by a first pivot at one end and each having the other end pivotally connected to the ends of said clutch members and arranged so that movement of said first pivot in an outward radial direction moves said clutch members apart, a second pivot mounted on said mandrel between said first pivot and a hub positioned at the central axis of said mandrel, a lever mounted on said second pivot, said lever extending on one side of said second pivot to engage said pair of links and extending on the other side of said second pivot to a point beyond said hub, a directly operable manual actuating handle adapted to be axially displaced along said hub, said handle having an outside peripheral dimension which is less than the peripheral dimensions of said clutch members, a slotted channel member carried by said handle, and means pivotally connecting the end of said other side of said lever to the slot in said channel member.

2. A reel mandrel comprising a pair of arcuate clutch members adapted to be radially expanded, a pair of links pivotally connected together by a first pivot means at one end and each having the other end pivotally connected to the ends of said clutch members and arranged so that movement of said first pivot in an outward radial direction moves said clutch members apart, said first pivot means comprising an elongated member mounted on said mandrel along a radius thereof and positioned within a bearing means for longitudinal movement, said member having an opening therein adapted to receive one end of an actuating means, a second pivot mounted on said mandrel between said first pivot and a hub positioned at the central axis of said mandrel, a lever forming said actuating means mounted on said second pivot, said lever extending on one side of said second pivot to engage said first pivot means at the opening of said elongated member and extending on the other side of said second pivot to a point beyond said hub, a directly operable actuating handle adapted to be axially displaced along said hub, a slotted channel member carried by said handle, and means connecting said other side of said lever to the slot in said channel member.

3. A reel mandrel as defined in claim 2 wherein said elongated member is adapted to extend beyond the periphery of said clutch members and between said clutch members when said lever has been moved to an actuated position wherein said clutch members are expanded.

4. A reel mandrel comprising a pair of arcuate clutch members adapted to be readilly expanded, a pair of links pivotally connected together by a first pivot means at one end and each having having the other end pivotally connected to the ends of said clutch members and arranged so that movement of said first pivot in an outward radial direction moves said clutch members apart, said first pivot means comprising an elongated member mounted on said mandrel along a radius thereof and positioned within a bearing means for longitudinal movement, said member carrying a ball joint pivot with a cylindrical opening therein, a second pivot mounted on said mandrel between said first pivot and a hub positioned at the central axis of said mandrel, a lever mounted on said second pivot, said lever extending on one side

of said second pivot to project into said ball joint pivot and extending on the other side of said second pivot to a point beyond said hub, a directly operable actuating handle adapted to be axially displaced along said hub, a slotted channel member carried by said handle, and means connecting said other side of said lever to the slot in said channel member.

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