Retractable winding mandrel having a cylindrical casing slit in at least one location along the line parallel to the axis of the casing, there being abutments on the casing on each side of the slit and a cam means reciprocable between the abutments so as selectively to expand the casing, the casing being retracted or decreased in diameter when it is desired to remove a wound body therefrom.

3 Claims, 2 Drawing Figures
RETRACTABLE WINDING MANDREL

This invention relates to winding mandrels which are particularly adapted for the manufacture of tubes or similar cylindrical objects obtained by a cross-winding of fibers impregnated with a desired polymerizable resin.

It is now well-known to manufacture cylindrical objects by the winding of threads, ribbons, or felt impregnated with heat-hardenable resins upon a mandrel. After the wound object has been heated in order to polymerize the resin, the object is then extracted from the mandrel. In most cases the mandrel is a simple cylinder; as a result, very substantial forces are required to be exerted between the mandrel and the wound object because, on the one hand of the adherence of the polymerized material to the surface of the mandrel, and, on the other hand, to the effective friction between the wound object and the surface of the mandrel due to the tension under which the impregnated fibers or threads were wound.

The invention has among its objects the facilitating of the extraction of the mandrel from the wound cylindrical object. The invention displays particular advantages when the wound object is of a large diameter. In accordance with the invention there is provided a retractable winding mandrel the external diameter of which may selectively be reduced. More particularly, the retractable winding mandrel according to the invention has a cylindrical casing slit along at least one of its geometrical elements, the casing being provided with abutments disposed on each side of the slit and with cam means movable between such two abutments so as selectively to space the edges of the casing on the respective sides of the slit through desired distances. In a preferred embodiment of the mandrel, illustrated herein, the abutments on the casing on the respective sides of the slit therein are in the form of rollers, and the cam means is reciprocal parallel to the longitudinal access of the mandrel, the cam means being elongated and having cam surfaces engaging the respective abutments which are mirror images of each other.

In the accompanying drawings which form a part of the disclosure herein there is illustrated a preferred embodiment of mandrel in accordance with the invention. In the drawings;

FIG. 1 is a fragmentary view in transverse section through a retractable mandrel in accordance with the invention, the mandrel being shown partially expanded;

FIG. 2 is a view in longitudinal section parallel to the access of the mandrel, the section being taken along the line II—II in FIG. 1.

In FIG. 1 there is shown a portion of a retractable mandrel in accordance with the invention, that mandrel being generally designated by the reference character 10. The mandrel 10 is adapted to wind resin-impregnated fibres to thereon to manufacture cylindrical objects such as tubes. The mandrel 10 has a cylindrical casing 12 which is retained in shape in a known manner by a plurality of circumferentially spaced axially extending longitudinal girder members 14 affixed to the casing, and a plurality of axially spaced web members 16 (one pair shown) disposed in planes transverse to the axis of the mandrel.

As shown, the casing 10 and the pairs of web members 16 are slit radially along a longitudinal axial plane of the mandrel, the gap or spacing 18 between the confronting edges of the pair of web 16 and between the confronting edges 20, 22 of the casing 12 being alterable, whereby to vary the effective diameter of the mandrel as a whole. Such selective spacings of the confronting edges of the mandrel at the slit is effected by the cooperation of an axially reciprocable cam 24 having opposite cam surfaces 40, 42 which are mirror images thereof, the surfaces 40, 42 diverging in a direction into the paper in FIG. 1 and upwardly in FIG. 2. The cam surfaces 40 and 42 cooperate, respectively, with rollers 32 and 34 which are affixed to stub shafts on the confronting ends of the respective web members 16, as shown.

In order to maintain the confronting edges 20, 22 of the casing 12 at the slit in alignment throughout the range of adjustment of the mandrel, there are provided a plurality of pins 36 which extend in a direction generally tangential of the casing 22 and are spaced axially of the mandrel, such pins being mounted on a member 14 adjacent one side of it slit, the pins 36 being accurately received within similarly oriented bores 38 in the member 14 on the other side of the slit of the casing 12. The interaction of the pins 36 and of the bores 38 prevents any shifting of the two confronting edges of the mandrel at the slit in either an axial or a radial direction, thereby preventing any twisting deformation of the mandrel 10.

A cam 24 is provided with a stem means 30 by means of which the cam may be selectively moved in opposite directions in order to expand and retract the mandrel as required. It will be understood that the structure shown in FIG. 2 of the drawings is repeated at each position longitudinal of the mandrel whereon there are located a cam means 24 and rollers 32, 34 cooperating with such cam means, the cam means 24 being joined by a bar or stem similar to the portion 13 of a cam means shown in FIGS. 1 and 2.

The above described retractable mandrel operates as follows: Before the winding operation has begun, the stem 30 of the cam means is thrust in the direction of the arrow F in FIG. 2 by suitable pushing and pulling means (not shown) until the opposite cam surface 40, 42 engage the respective rollers 32, 34 and thrust the opposing edges of the mandrel structure apart in the respective directions F, F' as shown by the oppositely facing arrows in both FIGS. 1 and 2. The transverse web members 16 are elastic, and the parts are so constructed and arranged that with the cam means 24 retracted from engagement with the roller 32, 34 the opposing edges of the mandrel at the slit 18 will come into contact. After the impregnated fibres threads and alike have been wound upon the mandrel which has been expanded in the manner above described, and after the polymerization of the tube or the cylindrical object thus formed by the wound fibres, the stem 30 with the connected cams 24 are pushed back, thereby to remove the surfaces 40 and 42 of the cam from the rollers 32 and 34 and thus to allow the resiliency of the members 30 to close the gap 18. The mandrel is then in a condition to be retreated from the wound object, there being a sufficient space between the outer surface of the casing 12 of the mandrel and the inner surface of the wound object to permit the ready separation of the two.

It is to be understood that the inclination of the opposed cam surfaces 40, 42 may be small, so that the
mandrel may be held in the “open” position shown in FIG. 1 by the imposition of a relatively small longitudi-

dlly directed force upon the stem 30 and thus upon the cam 34. This is important when the mandrel is em-
ployed for certain winding processes wherein the im-
pregnated fibres have to be wound upon the mandrel and polymerized under great tension.

It is to be understood that the invention is not limited to these specific embodiments shown herein, and that the configuration and disposition of the cam means 24 and the cooperating abutments 32, 34, as well as the means for moving the cam may be varied widely within the scope of the present invention.

Although the invention is illustrated and described with reference to one preferred embodiment thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a preferred embodiment but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. A retractable winding mandrel comprising a cylin-
drical casing, the casing being divided along at least one axially extending line, the mandrel having support-
ing structure within the casing, the supporting structure being divided along a slit which extends along the same longitudinal line as the casing, abutment means sup-
ported upon the supporting structure on the respective sides of the slit, and cam means selectively movable in opposite direction between the abutments whereby to vary the degree of spacing of the confronting ends of the casing and its supporting structure at the slit whereby to vary the effective diameter of the mandrel, the casing and its supporting structure being resiliently deformable and constantly tending to contract the mandrel toward its slit-closed closed position.

2. A retractable winding mandrel according to claim 1, wherein the abutments on the respective sides of the slit in the mandrel are similarly disposed, the cam is reciprocable in a direction parallel of the axis of the man-
drel, and the cam has cam surfaces on the opposite side thereof cooperating with the respective abutments, the cam surfaces on the opposite sides of the cam being substantially mirror images of each other.

3. A retractable winding mandrel according to claim 1, wherein the mandrel is axially elongated, and com-
prising a plurality of a similar sets of abutments and cams as spaced longitudinally of the mandrel, the cams at the respective locations of the abutments being connected by a stem which extends longitudinally of the mandrel.

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