Feb. 24, 1970 W. D. LANDGRAF 3,497,050

RIBBON SPOOL WITH FRICTIONAL RIBBON ATTACHING MEANS

Filed April 24, 1968

FIG.1

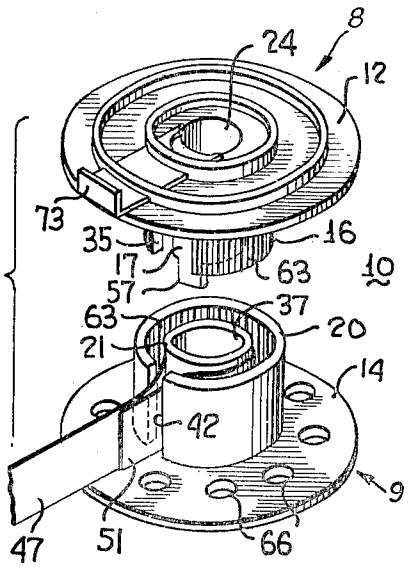


FIG.2

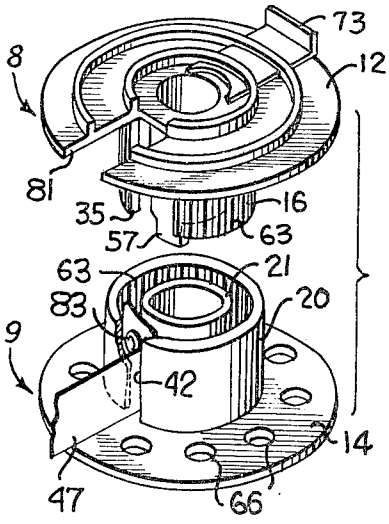


FIG.3

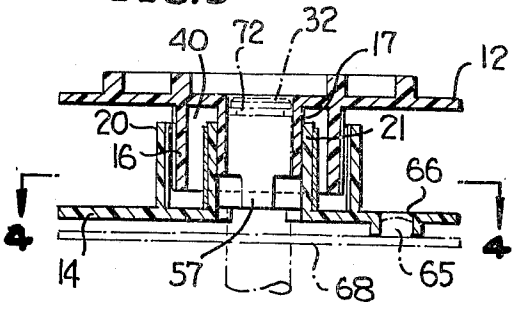


FIG.5

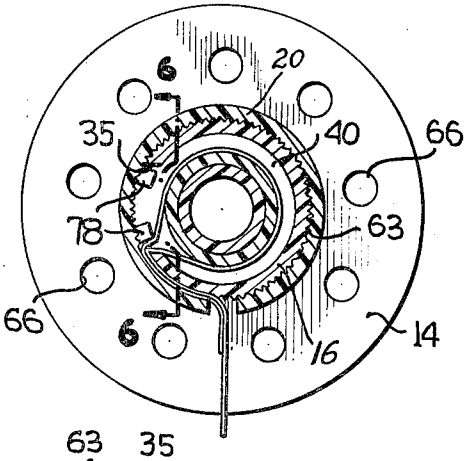
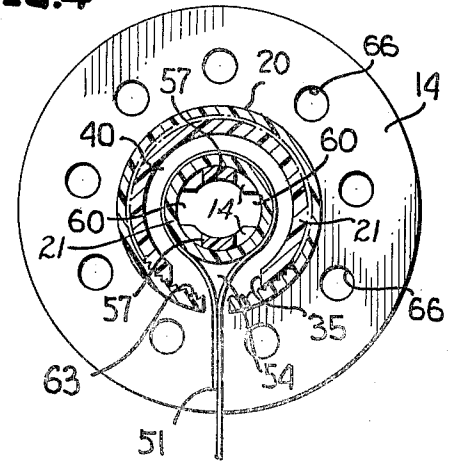


FIG.4



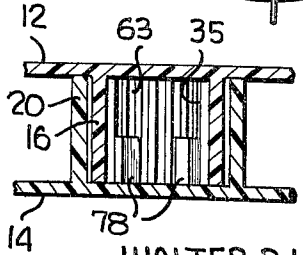


FIG.6

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RIBBON SPOOL WITH FRICTIONAL RIBBON ATTACHING MEANS

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Continuation-in-part of application Ser. No. 519,154, Jan. 6, 1966. This application Apr. 24, 1968, Ser. No. 723,854

Int. Cl. B41j *35/00;* B65h *75/28*

U.S. Cl. 197—175 5 Claims

ABSTRACT OF THE DISCLOSURE

A ribbon spool has a pair of joinable and separable members, each including a flange and a pair of coaxial spaced tubular hubs projecting therefrom. The hubs of the two members are so dimensioned that the inner and outer hubs of one member mate respectively with the inner and outer hubs of the other, leaving between the two sets of mated hubs a gap of sufficient width to accept the ribbon to be wound thereon. The mated hubs are separable upon application of sufficient oppositely directed outward axial forces. Each of the outer hubs contains a slot to permit passage of the ribbon therethrough when the slots are aligned. The ribbon is held captive in the gap between the two sets of mated hubs when the members are joined and rotated relative to one another into a position of complete engagement at a predetermined point of angular orientation, at which point the members become relatively irrotational.

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is a continuation-in-part of my co-pending application, Ser. No. 519,154, filed Jan. 6, 1966, entitled "Ribbon Spool," now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates generally to ribbon spools for use in business machines, such as typewriters and adding machines, and more particularly to improvements in ribbon spool structure to facilitate the attachment of the inked ribbon to the spool, and to render the separable spool components irrotational relative to one another when in the joined condition.

In the past, means for fastening or attaching an inked ribbon to a typewriter spool have been provided primarily in the form of prongs, tabs, posts, slots, spring members, and so forth, which are associated with or part of the hub on which the ribbon is wound. Each of these previous types of ribbon attaching devices has generally required the provision of an added member on the ribbon end, or of a slit or a cut in the ribbon end, to mate therewith on the spool. Hence, in addition to the resulting problems raised in the manufacture of the spool structure itself, it has generally been necessary to further process the inked ribbon for the provision of the aforementioned added member thereon, leading to higher production costs, as well as increasing the number of sources of failure. It has also been suggested in the prior art that a pair of flange members having mating relatively rotational hubs be provided with alignable slots to permit the end of an inked ribbon to be passed through the aligned slots, and the slots and hubs then rotated such that a ribbon end is caught between opposing surfaces of the mated hubs thereby securing it to the spool itself. These arrangements have been found to have inadequate clamping power, such that in use of the spool the ribbon frequently is pulled loose from the spool. This disadvantage is compounded by the fact that the hubs of the spool are relatively rotational so that even if the ribbon end were tightly

bound or grasped between opposing surfaces of the mating hubs there may occur gradual rotation of the hubs tending to produce realignment of the slots, and with it, escape of the ribbon end from the hubs.

Accordingly, it is a principal object of the present invention to provide an improved ribbon spool that overcomes the aforementioned disadvantages and limitations of the prior art spools.

Quite obviously, the changing of a worn ribbon in a business machine is an unpleasant task at best, usually resulting in soiled fingers, and often in frustration, where the machine operator lacks the dexterity required to attach and detach the ribbon to and from the spool. It is therefore a further object of the present invention to provide an improved ribbon spool wherein a particularly simple, yet reliable, ribbon attaching means is provided.

Another object of the invention is to provide a ribbon spool which utilizes a ribbon attaching means requiring no mating component or special fastener on the ribbon itself for attachment of the ribbon to the spool, and yet which insures a reliable engagement between ribbon and spool despite continued and lengthy use in a business machine. In conjunction with the above objects, it is a further object of the invention to provide a ribbon spool having a ribbon attaching means which may be completely exposed so as to be readily accessible to the machine operator when ribbon replacement is required.

SUMMARY OF THE INVENTION

Briefly, an embodiment of a ribbon spool according to the present invention comprises a pair of flange members, each having a pair of coaxially projecting spaced tubular hubs. The hubs of one flange member are arranged and adapted to mate with hubs of the other whereby a double flange spool is formed which is readily separable into its two component parts. Each of the outer hubs, that is, the outer hub of each flange member, is provided with a slot or opening in the wall thereof, extending in the axial direction from the free end or rim thereof (that is, the end opposite that secured to the flange) and preferably running the full length of the hub.

The ribbon is attached by separating the two spool components and looping the end of the ribbon about the outer wall of the larger diameter one of the two inner hubs of the spool components, with both ends of the loop extending outwardly of the slot in the outer hub of the same component. The spool is then assembled so that the slot in the outer hub of the other component slips over the loop ends without interference. A simple twist of the two spool components relative to one another then insures that the ribbon is reliably secured to the spool by virtue of the clamping or gripping action of the opposing surfaces of the mating hubs, and the fact that both ends of the loop of the ribbon are grasped between the hubs. Since the two spool components are readily separable from one another, the ribbon attaching means is completely accessible to the person changing the ribbon and no great dexterity is required to effect the ribbon replacement. It is, of course, necessary to remove the worn ribbon after the components are separated and prior to the fastening of the new or replacement ribbon to the spool.

Because secure ribbon attachment depends, in spools according to the present invention, primarly upon the looped configuration of the ribbon and the frictional forces between the loop and the mating hubs, there is no requirement of a special fastener or mating component on or adjacent to the ribbon end as is necessary for ribbon attachment in many prior art spools. To further insure the reliable binding of the ribbon between opposing surfaces of the mating hub members, those surfaces are knurled or

otherwise provided with a relatively high coefficient of friction.

To ensure that the spool components are not relatively rotatable when complete mating is achieved, yet are free to rotate in the partially mated condition to allow the twisting of and the gripping action by the hub members, means are provided on the spool components for cooperating engagement and locking the components irrotationally when a predetermined degree of engagement has been achieved. Such means are provided, for example, in the form of projections on one component and an opening or slot on the other whereby to permit complete nesting of the components together in only one position of relative orientation. The spool components can thus be relatively rotated after the ribbon is inserted in the looped position, until the projections are engaged in the slot in the aforementioned position of complete mating. Thereafter, relative rotation of the spool components cannot occur because the total width of the projections is substantially the same as the total width of the slot.

To prevent the spool components from separating while the spool is in use in a business machine the spool is provided with a locking lever which is adapted to engage the driving spindle of the ribbon-feed mechanism of the machine. The locking lever is arranged so that it is movable relative to the axis of the spool (and thus relative to the driving spindle), whereby the spool may readily be locked to and released from the driving spindle as necessary or desired for ribbon or spool replacement.

While ribbon spools according to the present invention are primarily intended for use with a ribbon having no special fasteners or mating components; that is, the plain ribbon end is merely looped about the larger of the two inner hubs prior to mating of the hubs, and the ends of the loop are brought outwardly of the outer hub on the same spool member via the aforementioned slot; nevertheless, it is also contemplated that the spool may be utilized with ribbons having added attaching means. In this alternative utilization of the spool, a ribbon having an element such as a tab, clamp, or eyelet at or near one of its ends is attached to the spool by insertion of that element into the space between inner and outer hubs of the larger-hubbed spool member, with the remaining portion of the ribbon extending outward of the outer hub via the slot therein. Typically, this slot is sufficiently narrow to prevent the thicker element from passing therethrough, particularly since the element is unable to assume a position of direct (i.e., head-on as opposed to cocked) egress from the slot, by virtue of the limiting width of the space between the hubs. The mating spool member is then positioned for engagement with the first spool member in the same manner as where a ribbon loop is employed, as described earlier. Since a ribbon loop is unnecessary, however, the ribbon spool for this embodiment may be modified by cutting or forming a radial slot in the flange of the mating spool member such that the ribbon element may be inserted into or removed from the gap between the two sets of hubs while the spool members are in a condition of mating engagement.

BRIEF DESCRIPTION OF THE DRAWING

The above and still further objects, features and attendant advantages of the present invention will become apparent from a consideration of the following detailed description of certain preferred embodiments thereof, especially when taken in conjunction with the accompanying drawings, in which:

FIGURES 1 and 2 are exploded views, in perspective, of an embodiment of a ribbon spool in accordance with the present invention, and of a modification thereof, respectively;

FIGURE 3 is a sectional view of the assembled ribbon spool of FIGURE 1 (or FIGURE 2) with the components thereof in partial mating engagement and the spool shown in otherwise operating position on a portion of a spool driving mechanism of a typical business machine;

FIGURE 4 is a sectional view of the partially assembled spool taken along the lines 4—4 of FIGURE 3 and illustrating the looping of the ribbon prior to final securing thereof, and the relative positions of the rotation-preventing elements at that time;

FIGURE 5 is a sectional view of completely assembled or joined spool, generally similar to that shown in FIGURE 4, but encompassing another embodiment of the rotation-preventing means, and illustrating the relative arrangement of hubs and ribbon loop when the spool components are twisted to the final position of insertion; and

FIGURE 6 is a fragmentary sectional view taken along the lines 6—6 of FIGURE 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, wherein like numerals refer to like parts in the several figures, and with particular reference to FIGURE 1, ribbon spool **10** comprises a pair of spool components **8, 9** having respective flange members **12** and **14**, preferably of circular shape, and each having a pair of coaxial spaced tubular hubs **16, 17**, and **20, 21**, respectively, projecting from a surface thereof. Inner hub **17** of spool component **8** has an axial hole **24** extending therethrough, of sufficient diameter to accept the upstanding driving spindle **32** (FIGURE 3) of a business machine in which the spool **10** is used. Outer hub **16** of spool component **8** is coaxial with hub **17**, the walls of the two hubs **16, 17** being spaced apart from one another, for reasons which will become clear presently.

Outer hub **16** has an opening or slot **35** within its wall, the slot **35** extending from the free end or rim of the hub **16**, preferably to the flanged surface from which the hub **16** projects.

Spool component **9** also has a projecting inner hub **21** having an axial hole **37** extending therethrough, the hole **37** being of sufficient diameter to accept hub **17** with a tight fit between the walls of these two mating hubs **17, 21**. Outer hub **20** of spool component **9** is coaxial with hub **21**, the walls of the two hubs **20, 21**, like those of hubs **16** and **17**, being spaced apart from one another. The inner diameter of hub **20** is sufficient to permit insertion of hub **16** therein with a relatively close fit between the walls of these two mating hubs **16, 20**, the space between hubs **16, 20** to accommodate and hold captive the ribbon **47** as will be discussed.

Hence, when the two spool components **8, 9** are joined together, i.e., are assembled, they form a double flange spool **10**, with hub **17** nesting within hub **21** and hub **16** nesting within hub **20**. In this assembled configuration the spacing of the hubs **16, 17**, and **20, 21** of each spool component **8, 9**, respectively is such that a gap **40** exists between the outer surface of hub **21** and the inner surface of hub **16** (see, e.g., FIGURES 4 and 5). The distance between the flanges **12, 14** of the assembled spool **10** is of course determined by the height of the projecting hubs **16, 17** and **20, 21** and should be sufficient to permit a standard inked ribbon **47** to be wound in layers about the outer surface of hub **20**. The hub **20** also has an opening or slot **42** in its wall, extending longitudinally from the rim thereof to the flange surface from which the hub **20** projects, but preferably slot **35** in hub **16** is considerably wider than slot **42**, for reasons which will be discussed presently.

Each of the two spool components **8, 9** may readily be molded in one piece construction of any suitable plastic material, such as phenolic resin, which is easily machined in the hardened state.

To attach the inked ribbon **47** to the spool **10**, the spool components **8, 9** are separated, the worn ribbon (if any) removed, and the ribbon **47** is looped about the outer surface of hub **21** with the ends of the loop extending out-

wardly of slot 42 in hub 20 in the manner illustrated in FIGURE 1. At this point in the ribbon attachment operation the two spool components 8, 9 are still separated. The ribbon end 51 preferably extends about ½ inch beyond the wall of hub 20, although this dimension of projection is not critical, it being only desirable that both ends of the ribbon loop be frictionally clamped, as will appear presently.

After the ribbon end 51 is looped about hub 21 in the aforementioned manner, the other spool component 8 may be placed over the ribbon loop-supporting component 9 as shown in FIGURE 3, with slot 35 in alignment with slot 42. Thus, when the spool 10 is assembled the ends of the loop extend freely through the passageway formed by the two slots 35, 42 as shown most clearly in FIGURE 4. Accordingly, it will be appreciated that one reason for the wider slot 35 in hub 16 is to permit the simple assembly of the two components 8, 9 without danger of undesired ribbon binding despite the relatively wider portion of the loop existing in the vicinity of point 54 (FIGURE 4). Rapid ribbon attachment is most easily effected by grasping the loop ends as the upper spool component 8 is inserted in the lower component 9 to insure that the ribbon 47 is not inadvertently caught between hub 16 and opposing flange 14.

In the preferred embodiment, inner hub 17 of spool component 8 is provided at its rim portion with longitudinal projections 57 spaced 180° apart. Spool component 9 on the other hand is provided in the region of the flange 14 adjacent the central hole 37 with diametrically opposite slots or openings 60 dimensioned and spaced to receive the projections 57 extending from the rim hub 17. Accordingly, as shown most clearly in FIGURES 3 and 4, the spool portions or components 8 and 9 cannot be fully engaged while slots 35 and 42 are aligned because the edge of each projection 57 abuts against an unviolated portion of the flange 14 adjacent central hole 37. When the upper spool portion, i.e., component 8, is twisted or rotated 90° in a clockwise direction as viewed in FIGURE 4, the ends of the ribbon loop are grasped securely and held captive between opposing surfaces of the two outer mating hubs 16, 20 (e.g., in a manner similar to that shown in FIGURE 5), and projections 57 on the inner hub 17 of component 8 enter slots or openings 60 in the flange 14 of component 9 such that complete mating of the two components 8, 9 is achieved and they are rendered irrotational relative to one another. The captive ribbon 47 is shown most clearly in FIGURE 5, although this figure is also used to illustrate another embodiment of the rotation-preventing means. Thereafter, the spool components 8, 9 cannot be relatively rotated, while fully engaged. Knurling 63 is provided on the inside surface of hub 20 and the outer surface of hub 16 as shown in FIGURES 1, 2, 4, and 5, to prevent slippage of ribbon 47 when the spool 10 is in use in a business machine, although as previously observed the fact that both loop ends are held captive between mating hubs 18, 20 provides great assurance that the ribbon 47 is securely retained on the spool 10 when in use. As shown in FIGURES 4 and 5, the ribbon loop extends about hub 21 in single layer, then proceeds in double layer through the slot 35 and is then gripped between the serrated or knurled surfaces 63 of hubs 16 and 20, and finally proceeds to the exterior of hub 20 through slot 42.

A plurality of apertures 66 are provided in the flange 14 of spool member 9, the apertures 66 being equally spaced about a common circle concentric with the axis of the flange 14 so that any one of them will accept the post 65 upstanding from the rotatable flange 68 of the spool drive mechanism of the business machine (FIGURE 3). Other spool structures may, of course, be provided to mate with the driving mechanism of the machine in which the spool is to be used, depending upon the particular machine involved.

To prevent the spool components 8, 9 from separating when the spool 10 is in use, a lever such as sliding element 73 (FIGURE 1) may be provided by which to lock the spool 10 to the spindle 32 of the machine. The particular details of the construction of element 73 and the manner in which it is slidably fastened to the spool flange 12 are disclosed in detail in my United States Patent 3,323,743, issued June 6, 1967, entitled "Ribbon Spool," and need not be elaborated upon here. It is sufficient to note that any conventional locking lever, as for example the well-known pivoted type, may alternatively be employed for locking the spool 10 to the spindle 32 of the machine when in use. In general, all such levers are adapted to engage a slot, such as that designated by reference number 72 (FIGURE 3), in the spindle 32.

An alternative embodiment of the rotation-preventing means, that is, the means for insuring that the spool components 8, 9 are relatively irrotational when assembled in complete mating engagement, is shown in principal part in FIGURES 5 and 6. Referring to those figures, it will be observed that the outer hub 20 of spool component 9 is provided along its inner surface, adjacent the flange 14, with longitudinally extending ribs or projections 78, preferably extending no more than about halfway up the inner surface of the hub 20. Accordingly, the spool portions 8 and 9 cannot be fully engaged while slots 35 and 42 are aligned with the ribbon loop in the position generally shown in FIGURE 4, because the lower edge of hub 16 abuts on these ribs or projections 78. The circumferential separation between the ribs 78 at their outermost points is preferably only slightly less than the width of slot 35, in order to accommodate the two thicknesses of ribbon 47 as shown in FIGURE 5. It follows that in turning or rotating spool component 8 relative to component 9 the slot 35 may be aligned with ribs 78 whereupon the spool components 8, 9 may be fully engaged. With this full engagement the spool components 8, 9 cannot be relatively rotated. The embodiment shown in the earlier-described figures is preferred over that shown in FIGURES 5 and 6 because there is less chance that the ribbon will prevent complete nesting of the components 8, 9 when the respective projections 57 and slots 60 are mated with one another.

Referring now to the modification shown in FIGURE 2, it will be observed that in practically every respect the ribbon spool components 8, 9 are identical to those previously described, except that a radial slot 81 disrupts the continuity of the flange 12 of component 8, and the thickness of outer hub 20 of component 9 may be reduced slightly in a region immediately adjacent either side of slot 42 to permit ease of insertion of an eyelet, tab, post, or other added element 83 at or near the end of ribbon 47. In FIGURE 2, the upper portion of the outer hub 20 has been broken away adjacent slot 42 to show more clearly the position of eyelet 83 in the gap between hubs 20 and 21.

In use of the spool of FIGURE 2, the eyelet 83 is inserted in the space between the hubs 20, 21 of component 9 as the ribbon 47 is axially slipped into slot 42. The spool components 8, 9 are then mated in the same manner as previously described, and the two components 8, 9 then rotated until they undergo complete engagement at a position of angular orientation in which they become relatively irrotational. The means for achieving this locked mating configuration may be identical to those embodiments previously discussed in connection with FIGURES 3–6.

Instead of inserting the eyelet end of the ribbon 47 into the space between the hubs 20, 21 of one spool component 9 prior to joining the spool components 8, 9 together, the components 8, 9 may first be joined such that slot 81 in the flange 12 of component 8 is aligned with slot 42 in outer hub 20 of component 9. The eyelet 83 is then

inserted into the gap **40** between the two sets of mated hubs **16**, **20** and **17**, **21** via slot **81**, the remaining portion of the ribbon **47** extending through slot **42** outwardly of hub **20**. As before, the spool members **8**, **9** are then twisted (i.e., relatively rotated) until they assume a position of complete engagement as determined by the location of the projections **57** and slots **60** of FIGURE 4, or of projections **78** and slot **35** of FIGURES 5 and 6, in the spool of FIGURE 2.

What is claimed is:

1. A ribbon spool for a business machine, comprising

first and second separable relatively rotatable single flange spool members having oppositely disposed interior flange surfaces and a common axis,

first and second coaxial, cylindrical, radially spaced tubular hubs projecting from the interior flange surface of said first spool member and extending concentrically of said axis, said first hub being closer to said axis than said second hub and having an axial hole therethrough of sufficient diameter to accept the spool driving spindle of said business machine,

third and fourth coaxial cylindrical radially spaced tubular hubs projecting from the interior flange surface of said second spool member and extending concentrically of said axis in axially telescopic mating relationship with said first and second hubs, respectively, said third hub being closer to said axis than said fourth hub,

the radial spacing between said first and second hubs and between said third and fourth hubs being sufficient, with said hubs in said telescopic mating relationship, to define a radial gap between the outer surface of said first and third telescoped hubs and the inner surface of said second and fourth telescoped hubs relative to said axis, said radial gap extending about the entire circumference of said outer surface of said first and third telescoped hubs and having a width greater than the thickness of the ribbon to be wound on said spool, to accept said ribbon in a loop about said outer surface of said first and third telescoped hubs,

said second and fourth hubs each having a slot extending parallel to said axis the entire length of the respective hub from the interior flange surface to the hub rim, said slot of each said second and fourth hubs having a circumferential width at least twice the thickness of said ribbon, to enable the ends of said ribbon, with said ribbon looped about said outer surface of said first and third telescoped hubs and said slots aligned, to extend from said gap outwardly of said second and fourth telescoped hubs via said aligned slots, and

means projecting from one of said first, second, third, and fourth hubs of one of said spool members for preventing full axial telescopic mating of said hubs for aligned angular relations of said slots, and an opening in the other of said spool members to accept said projecting means for enabling full axial telescopic mating of said hubs and for rendering said spool members irrotational at a predetermined position of angular misalignment of said slots,

said telescoped second and fourth hubs having confronting surfaces separated by a distance just sufficient to frictionally clamp two thicknesses of ribbon therebetween.

2. The combination according to claim **1**, wherein said projecting means comprises a projection on the inner surface, relative to said axis, of that one of said second and fourth hubs furthest from said axis, said projection extending radially toward said axis; and wherein said opening in said other spool member consists of said slot in that one of said second and fourth hubs closest to said axis, the last-named slot having a width sufficient to accept said projection and at least two thicknesses of said ribbon, and accepting said projection only with said spool members relaitvely rotated to said predetermined position of angular misalignment of said slots, to lock said spool members against relative rotation upon said full axial telescopic mating, and to clamp the ends of said loop extending from the slot in that one of said second and fourth hubs furthest from said axis between said confronting surfaces of said telescoped second and fourth hubs from said projection to said slot in that one of said second and fourth hubs furthest from said axis.

3. The combination according to claim **1** wherein said projecting means comprises a projection extending axially from the rim of said first hub; and wherein said opening comprises a slot in said flange surface of said other spool member of sufficient dimensions to accept said projection in locked relation, and accepting said projection in said locked relation only with said spool members in said predetermined position of angular misalignment of said slots in said second and fourth telecoped hubs, to lock said spool members against relative rotation upon said full axial telescopic mating, the ends of said ribbon loop extending from the slot in that one of said second and fourth hubs furthest from the axis being clamped frictionally between confronting surfaces of said telescoped second and fourth hubs during relative rotation of said spool members to said predetermined position of angular misalignment.

4. The combination according to claim **1** further including radially extending slot means in the flange of one of said spool members, extending from the edge of said flange to a point inwardly, relative to said axis, of said slot in that one of said second and fourth telescoped hubs closest to said axis, for exposing said radial gap with said hubs in axial telescopic engagement, to enable insertion of a ribbon having an eyelet at one of its ends into said radial gap while said hubs are telescoped, said radial gap having a width sufficient to accept the thickness of said eyelet, and said radially extending slot means exposing said radial gap sufficiently to accept the thickness of said eyelet.

5. The combination according to claim **1** further including movable lever means attached to the exterior flange surface of one of said spool members to engage said driving spindle with said spool mounted in said business machine for preventing separation of said spool members while said spool is in use in said business machine.

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