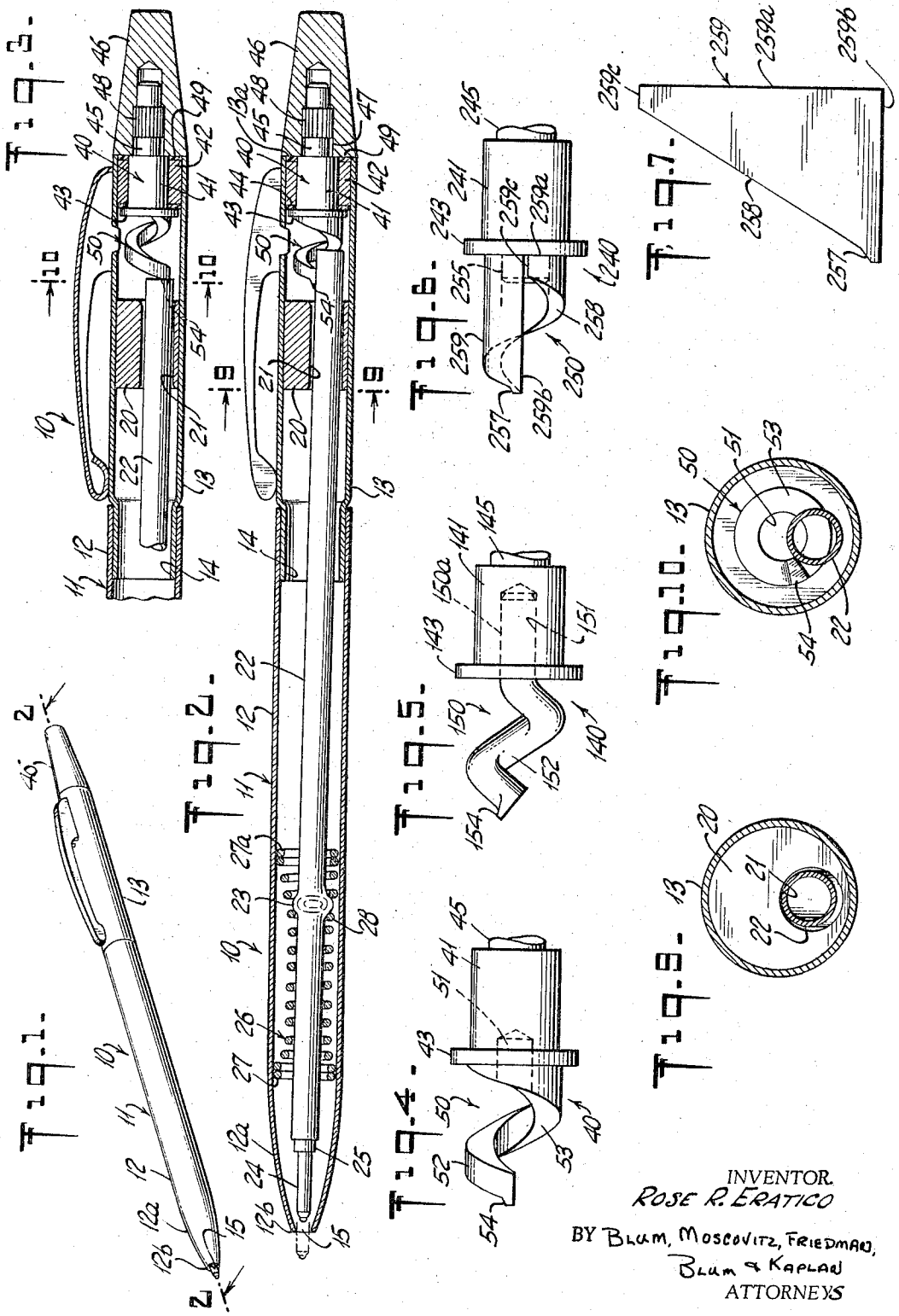
April 25, 1967 R. R. ERATICO 3,315,643

WRITING IMPLEMENT MECHANISM

Filed Sept. 9, 1963 2 Sheets-Sheet 1



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Filed Sept. 9, 1963 2 Sheets-Sheet 2

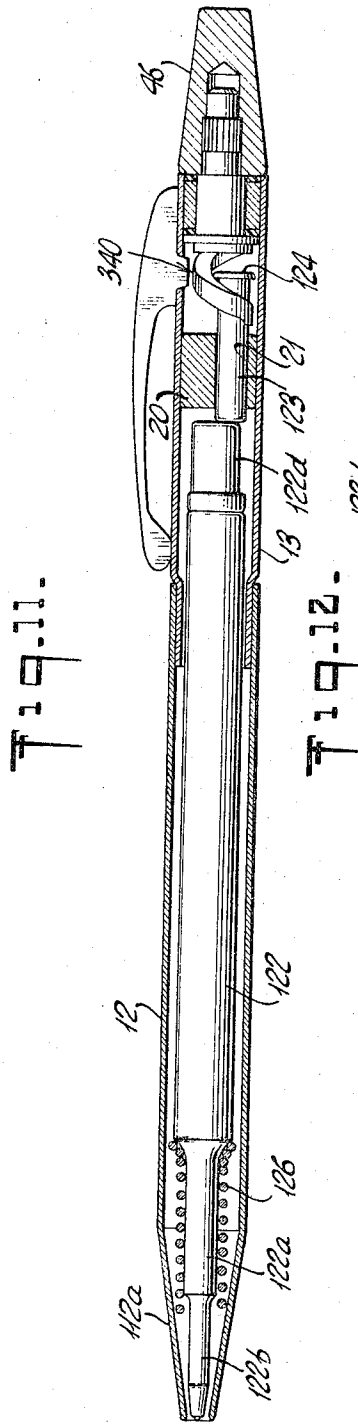

FIG. 11.

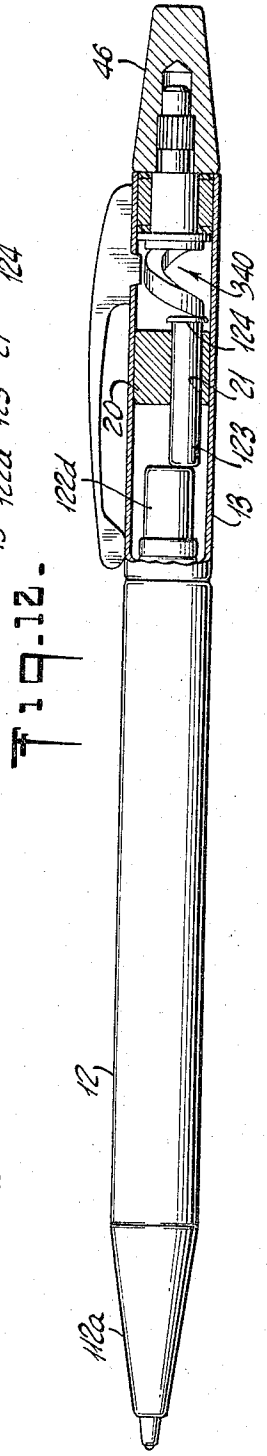

FIG. 12.

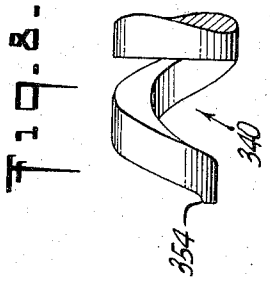

FIG. 8.

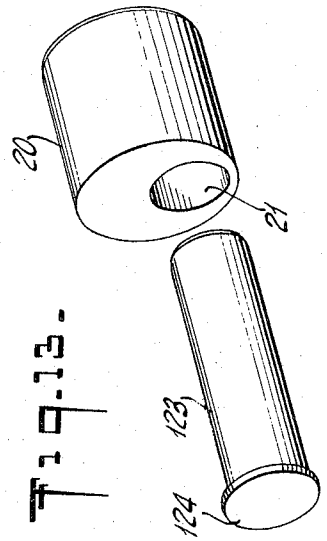

FIG. 13.

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WRITING IMPLEMENT MECHANISM

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7 Claims. (Cl. 120—42.03)

This invention relates to an improved mechanism for extending and retracting an implement in a casing.

While the invention will be described with particular illustrative reference to a retractable ballpoint pen, it will be apparent that the invention is applicable to other marking devices, and that in fact the mechanism can be used to extend and retract many other objects.

It is common practice to make ballpoint pens wherein the tube or refill containing the ink and the writing means is normally wholly retracted in a casing, with means provided to extend the tube or refill out of the casing for writing purposes. In one common general type of mechanisms, a button or other device is pushed to propel or extend the tube, and a catch is released, for example, by pushing the button, to permit retraction of the tube by means of a spring. Vast quantities of writing tubes or refills, of generally standard size and shape, are manufactured for use with mechanisms of this type.

In another type of mechanism action, a rotary member such as a cap, is mounted upon the cap and may be turned to actuate mechanism to extend or retract the tube, as the case may be. Such mechanisms have commonly required the use of a special refill tube, different in construction from the refill tube commonly sold for the pushbutton type mechanisms. Furthermore, such mechanisms using a rotary actuating member have required a relatively considerably number of parts.

One object of this invention is to provide a mechanism utilizing a rotary actuating member, but having a minimum number of parts, and suitable for use with the standard, widely sold refill tube, as well as with any other suitable device to be extended and retracted.

Another object of the invention is to provide a mechanism of the above described type utilizing inexpensive parts, and easily assembled.

Another object of the invention is to provide an improved impeller of the above described type, having simple stop means limiting turning of the impeller between limit positions wherein the tube is respectively retracted and extended.

In accordance with preferred embodiments of the invention, the mechanism comprises a hollow, tubular casing having a lower end opening, together with means within the casing receiving the tube or refill with the lower end of the tube extendable through the lower end opening and retractable into the casing. The tube receiving means maintain the tube skew to the casing axis with the upper end of the tube offset from the axis. For example, the bottom end opening may be located on the axis, and the upper end portion of the tube may extend through a bushing fixedly received within the bore of the casing, the bore of the bushing being offset from the casing axis.

Further in accordance with preferred embodiments of the invention, spring means couple the tube and the casing and normally maintain the tube in retracted position. An impeller is mounted within the casing above the tube so as to be rotatable about the axis and so as to be accessible externally of the casing for rotation of the impeller. The impeller has an axial motion drum cam shaped and positioned so that the spring maintains the upper end of the tube against the cam surface. The cam surface is shaped, for example, having a helical contour, so that turning of the impeller to one turned position causes extension of the tube and to another turned position permits the spring to retract the tube.

In another embodiment of the invention, the marking tube extends axially but terminates below the bushing. A pin extends through the offset bushing bore, one end of the pin being engaged by the impeller and the other end of the pin engaging the upper tube end.

It will be apparent that the invention utilizes simple parts. The special bushing with offset bore may be readily fabricated. The impeller may be readily produced in a variety of means, such as on a screw machine, by forming wire or by rolling flat metal stock. The remaining parts are of substantially conventional design.

Other objects and advantages of the invention will become apparent from the following description, in conjunction with the annexed drawing, in which preferred embodiments of the invention are disclosed.

In drawing,

FIG. 1 is a perspective view of a marking implement, illustratively a ballpoint pen, in accordance with this invention;

FIG. 2 is a longitudinal section on line **2—2** of FIG. 1, showing the point of the marking tube in retracted position in full lines and in extended position in broken lines;

FIG. 3 is a fragmentary view similar to FIG. 2, but showing the mechanism in tube-extending position;

FIG. 4 is a fragmentary side elevation, to enlarged scale, of one embodiment of the impeller;

FIG. 5 is a view similar to FIG. 4, showing a second embodiment of the impeller;

FIG.6 is a view similar to FIG. 4, showing a third embodiment of the impeller;

FIG.7 is a developed view of the impeller of FIG. 6;

FIG. 8 is a view similar to FIG. 4, showing a fourth embodiment of the impeller;

FIG. 9 is a section on line **9—9** of FIG. 2;

FIG. 10 is a section on line **10—10** of FIG. 3;

FIG. 11 is a longitudinal section of another embodiment of the invention, wherein the marking tube shown retracted, extends axially and is engaged by a pin extending through the offset bushing bore against the impeller;

FIG. 12 corresponds to FIG. 10, although partly in elevation and shows the marking tube extended; and

FIG. 13 is an exploded perspective view of the pin and bushing.

FIGS. 1–10

Upon reference to the drawings in detail, it will be noted that it shows a writing implement **10**, illustratively a ballpoint pen, comprising an elongated, hollow tubular casing **11** having open upper and lower ends. Casing **11** is preferably made in two parts, open-ended lower barrel **12** and upper cap **13**. Barrell **12** and cap **13** are tubular and of the same outer diameter. The lower end of cap **13** has an open-ended extension **14** of reduced diameter, over which barrel **12** fits frictionally, with the upper end of barrel **12** in abutment with the lower end of the main part of cap **13**, as clearly shown in the drawing. Alternatively, any other suitable means of interconnecting the two casing parts may be provided. The purpose of making casing **11** in two parts is to permit access to the interior for replacement of the marking tube. The lower end of barrel **12** is tapered at **12***a*, in the usual manner, to terminate in a reduced diameter lower end **12***b* having the circular lower barrel opening **15**. The axis of opening **15** preferably coincides with the axis of casing **11**.

Further in accordance with the invention, bushing **20** is fixed by frictional or other suitable means within cap **13**, intermediate the ends thereof. Said bushing **20** has

a through bore 21, the axis of which is parallel to but offset from the main axis of cap 13. Replaceable tube 22, which may be a common "ballpoint" tube, extends slidably through bushing bore 21 and through casing 11, and is also adapted to extend slidably through opening 15. Specifically, the upper part of tube 22 may be cylindrical, with a portion of tube 22 flattened at 23 near the lower end of tube 22 to widen the tube at the flattened point. The open end of tube 22 receives a conventional tip 25, the lower end 24 of which is of reduced diameter. The lower end of tube 24 is tapered at 24*a* and may contain the ball (not shown) in the usual manner. For convenience, the entire refill is designated as tube 22, it being understood that the main portion of tube 22 is of diameter to extend freely through bore 21, and that the tube 24 is of diameter to extend freely through opening 15. It will further be apparent that since the lower end portion of tube 22 (portion 24) extends through the axial opening 15, and the upper end of tube 22 extends through the axially offset bore 21, tube 22 is skew to the barrel axis with the upper end of tube 22 offset from the barrel axis.

Spring 26 couples tube 22 and casing 11 and is adapted to maintain tube 22 normally in retracted position. Spring 26 is a coil spring with its lower turns 27 frictionally received within barrel 12 at the point at which the taper 12*a* begins. The flattened tube portion 23 extends into spring 26, below the upper turns 27*a*. The flattened portion 23 is caught between a pair of successive intermediate turns 28 of the spring. FIG. 2 shows spring 26 operative to retract tube 22, spring 26 being thereby extended. It will be apparent that when refill 22 is lowered, spring 26 is compressed, in the usual manner. The hour-glass shape of the spring facilitates entrance of the refill tube into the spring, if the spring remains entrapped in the barrel 12 during a change of refill.

It will further be apparent that assembly of the refiill 22 with casing 11 is carried out with the two casing parts 12 and 13 separated, spring 26 dropped into barrel 12, tube 22 extended through spring 26 and cap 13 then placed upon lower barrel 12, thereby locating tube 22 extended through bushing bore 21.

Writing implement 10 further comprises an impeller 40 mounted within casing 11 so as to be rotatable about the axis of the casing and so as to be accessible externally of the casing for rotation thereof. Specifically, impeller 40 has a cylindrical shank portion 41 which is turnably received within bushing 42, this bushing 42 being fixedly received in the upper end of cap 13. Below bushing 42, shank 41 has a transverse peripheral flange 43 of increased diameter which is of the diameter of the bore of cap 13 and is turnable therein, said flange 43 being spaced from 42 by means of washer 44.

The upper end of shank 41 is at the level of the open upper end 13*a* of cap 13 and has a coaxial shaft extention 45 of reduced diameter which is received within knob 46. This knob 46 may take any suitable shape and is shown, strictly for illustrative purposes, as generally frusto-conical in shape and as downwardly tapered, with the lower end face of knob 46 being of about the same diameter as cap 13. Knob 46 has a bore 47 extending axially therein to its bottom face. Shaft 45 extends through bore 47. Knurled portion 48 of shaft 45, of slightly increased diameter, is frictionally and nonturnably force-fitted into bore 47. Washer 49 is mounted upon shank 41 between bushing 42 and knob 46. It will be apparent that the turning of cap 46 causes turning of impeller 40.

Below flange 43, shank 41, in the embodiment of FIGS. 1–4 and 9–10, has a drum cam portion 50 of slightly increased diameter. The cam 50 is in the form of a helix which is clearingly received within the bore of cap 13. In this embodiment, the cam 50 may be formed by making a bore 51 extending axially in element 50 from the lower end thereof and also extending into shank 41. Further, the element 50 may be formed with a helical screwthread 52 which is deep enongh to extend to the bore 51, as best shown in FIG. 4. The effect is to provide a helical cam surface 53 which optionally extends to complete turn. This cam surface 53 may be considered to be a drum cam surface of helical contour, it being understood that the term "helical" as used in the claims, will also encompass surfaces or edges usable in the same manner and having slightly different contours. In any event, this helical surface 53 is located in position so that the spring 26 maintains the upper end of tube 22 against such surface 53, as clearly shown in FIGS. 2 and 3. FIG. 2 shows the retracted condition of tube 22, in which its tip is wholly within casing 11 and in which the upper end of tube 22 abuts the upper portion of cam surface 53. In this position, the lower end portion of cam 50 abuts the side of tube 22, serving as a stop to prevent further retracting movement of cap 46. Accordingly, FIG. 2 shows one limit turned position of impeller 40.

When cap 46 is turned in the proper direction from its limit position of FIG. 2, the lower end of cam 50 moves away from the side of tube 22, and the upper end of tube 22 rides upon surface 53 so as to extend tube 22 so that the tip 25 is projected out of casing 11 through opening 15, as shown in broken lines in FIG. 2. The turning of cap 46 can be continued until the upper end of tube 22 is against the lower end portion of cam surface 53. At this lower end of surface 53, the surface 53 is provided with a stop projection 54 extending downwardly, as best shown in FIGS. 4 and 9. This projection 54 strikes the side of tube 22 to prevent further turning of impeller 40. This position of the parts, shown in FIGS. 3 and 9, corresponds to the other limit position of impeller 40, corresponding to the extended position of tube 22. Without stop 54, if cap 46 were turned past such limit position, the tube 22 would be abruptly retracted to its position of FIG. 2 (see discussion of FIG. 8 below). With the provision of the stop, impeller 40 must be turned in the reverse direction from its limit position of FIG. 3 to its limit position of FIG. 2 in order to retract tube 22.

The impeller may be produced in a number of economical ways. The cam 140 of FIG. 5 can be used instead of the cam 40 of the first embodiment. Elements 141, 143 and 145 correspond to elements 41, 43 and 45 respectively. The shank 141 is provided with an axial bore 151 extending to the lower end thereof. The cam 150, which replaces cam 50 in this embodiment, is in the form of a wire having a straight axially extending upper end portion 150*a* embedded in bore 151 and a lower portion 152 shaped into the form of a helix corresponding dimensionally and operationally to the cam helix 52 of the first embodiment. The lower end of cam helix 152 is provided with a stop projection 154 corresponding to stop projection 54 of the first embodiment. The operation of the element 150 corresponds to that of element 50 and does not require any extended discussion.

In the embodiment of FIGS. 6–7, the elements 241, 243 and 245 correspond to the respective elements 41, 43 and 45 of the first embodiment. The cam element 250 is formed from a metal sheet 259 having a rear edge 259*a*, longitudinal long side edge 259*b*, longitudinal short side edge 259*c* and a straight edge 258 on the diagonal and connecting the front ends of the edges 259*c* and 259*b*. At the connection zone of edges 258 and 259*b*, a generally rectangular stop 257 is formed, extending forwardly of and slightly spacing the edges 258 and 259*b*, as clearly shown in the developed plan view of FIG. 7.

To form the cam 250, the sheet 259 is rolled into tubular form, as shown in FIG. 6, with the edges 259*b* and 259*c* adjacent each other. As a result, the edge 259*a* assumes a generally circular shape. Furthermore, the edge 258 asumes a helical contour. The stop 257 corresponds to the stop 54 of the first embodiment. The edge 258 corresponds to the surface 53 of the first embodiment.

The formed cam 250 may be mounted in place upon the

impeller **240** by any suitable means. Thus, an axial stud **255** may be embedded in the element **241** and extend downwardly therefrom. The upper portion of the tubular cam member **250** may be extended frictionally upon the stud **255** and secured thereto by any suitable means, with edge **259***a* abutting element **243**.

Cam **340** of FIG. 8 is quite similar to cam **40** of FIG. 4 and other views. However, the stop surface **354** of FIG. 8 is angular rather than the right angular stop **54** of FIG. 4. As a result, in the extension position of FIG. 3 (compare FIG. 12, in which the same impeller is used), although the stop is against the side of the actuated tube (or pin, FIG. 12), a slight additional torque causes the stop to override the top of the tube (or pin) and return to retraction position of FIG. 2 (FIG. 11), permitting the tube (pin) to snap abruptly back to retracted position.

It will be apparent that the impeller, in addition to being formed from metal as shown, can also be formed by molding or other suitable process from plastic or other suitable material.

The operation of the implement **10** should be readily apparent from the foregoing. As described in detail above, the cap may be separated from the barrel and the spring and tube **22** mounted in place, and the cap returned so as to extend the tube **22** through bushing bore **21**, with the upper ends of tube **22** against the cam surface **53**. Knob **46** may then be manipulated to retract tube **22** with the lower end of cam **50** abutting the side of tube **22**. Knob **46** may be turned in the opposite direction to extend tube **22**, until stop **54** abuts the side of tube **22**. In the impeller embodiment other than that of FIG. 8, knob **46** must be turned reversely to retract tube **22**. This operation is also possible in FIG. 8, but alternatively, extra torque may be applied to carry the stop over the top of the tube and past it, to permit the tube to snap back to retracted position. It will be apparent that the mechanical operation of implement **10** is extremely simple, and further, that the mechanism uses a minimum of parts, all of which are readily fabricated. Furthermore, the refill **22** is of standard type and may be readily replaced.

FIGS. 11–13

This embodiment is the same as that of FIG. 1, with the exception of the replacement of impeller **40** by impeller **340**, as discussed above, and with the further exception of the replacement of tube **22** and tube **122** and pin **123**. Of course, it will be understood that any of the previously described impellers may be used in this embodiment. In addition, because of the changed configuration of the tube, the spring **26** is replaced by spring **126**.

Tube **122** is shorter than but of increased diameter relative to tube **22** and extends frictionally slidably through the bore of the barrel, terminating below bushing **20**. The lower end of tube **122** is of reduced diameter, at **122***a*, and then terminates in a still further reduced tip **122***b*. Tube portion **122***a* extends through the coil spring **126**, with one end of spring **126** against the tapered barrel portion **112***a* and the other end of spring **126** against the main part of barrel **122**. While barrel **12** is substantially the same as in the first embodiment, the tip **112***a* is optionally slightly more tapered and less rounded than tip **12***a* of the first embodiment. Tube **122** terminates at its upper end in a tube portion **122***d* of slightly decreased diameter.

Pin **123** extends slidably through the offset bore **21** of bushing **20**. The lower end of pin **123** engages the upper end of tube portion **122***d*. The upper end of pin **123** has a thin head **124** of slightly increased diameter which engages the cam **340**.

The operation of this embodiment is entirely similar to the first embodiment, except that when knob **46** is turned, the impeller engages the pinhead **124** rather than the tube. FIG. 11 shows the retracted position of the impeller with the stop against the side of the pin. Fig. 12 shows the extended position of tube **122**, with the stop against the head **124**. It will be apparent that in the case of the particular cam **340**, continued turning of cam **340** in direction to extend tube **122**, with sufficient increased torque, will carry the stop past the head of the pin and back to its position of FIG. 11, permitting abrupt snapback retraction of tube **122**. Alternatively, for a gradual retraction, the direction of turning of knob **46** may be reversed.

The head **124** is of greater diameter than bore **21** so as to prevent the pin from falling through the bore during the refill operation.

While I have disclosed a preferred embodiment of my invention, and have indicated various possible changes, additions and omissions which may be made therein, it will be apparent that various other changes, omissions and additions may be made in the invention without departing from the scope and spirit thereof.

With reference to the claimed subject matter, it will be noted that in each embodiment there is an extension and retraction mechanism comprising a casing having a hollow tubular casing bore with an axis and an end axial opening **15**. In each embodiment, there is a member in the bore (the tip **24** containing the ball, as illustratively shown in the first embodiment, but the member may take any other suitable form) in the bore and axially slidable between extended position, such as shown in broken lines in FIG. 2, in which the member (for example, tip **24**) protrudes out of opening **15** and position of retraction of the member in the casing relative to its extended position (such as shown in full lines in FIG. 2, but the member does not necessarily have to be fully retracted). In each embodiment, also, there are biasing means, illustratively shown as a spring, coupling the member and the casing and adapted to maintain the member normally in retracted position.

In each embodiment, there is an impeller mounted within the casing bore spaced from the member (such as tip **24**) and rotatable about its axis. In each embodiment, the impeller has an axial motion drum cam with a peripheral cam surface.

In each embodiment, there are means in the casing bore extending offset to the axis thereof and extending between the member and the cam surface. In the first embodiment, such offset means comprises the tube **22** itself which extends from the tip **24** toward the impeller, this tube **22** being offset to the axis since it extends through the offset bushing bore **21**. In the embodiment of FIG. 11, the offset means takes the form of the pin **123** extending through the offset bushing bore **21** and extending between the peripheral surface and the tube **122** which may be considered to be an extension of the retractable and extendible member **122***b*.

Finally, in each embodiment, the cam surface and the offset means are shaped, sized and positioned so that the biasing means (the spring) maintains the end of the skew means (upper end of tube **22** or pinhead **124** as the case may be) against the cam surface. The cam surface is in each embodiment further shaped so that turning of the impeller to one turned position causes extension of the member and to another turned position permits the biasing means to retract the member.

What is claimed is:

1. Writing implement comprising an elongated barrel having open upper and lower ends, an elongated cap having an open lower end and releasably mounted on the upper end of said barrel in axial alignment therewith, a bushing fixed in said cap and having a bore offset from the common axis of said barrel and cap, a replaceable tube extending slidably through said bushing and said barrel and having lower end writing means of the type described, an impeller having a shank extending axially in said cap above said tube and turnable about said axis, said shank having means accessible externally of said cap for manipulation to turn said shank in either direction, said impeller also having a helix depending from said shank coaxially therewith, said helix having an edge surface engaging the upper end of said tube, and spring

means coupling said tube and said barrel and urging said tube upwardly against said helix edge, said helix operative upon turning thereof in one direction to extend the lower end of said tube out of said barrel and in the other direction to retract said lower tube end into said barrel, said helix also having first positive stop means thereon engaging the side of said tube upon extension of said tube to prevent further turning of said helix in tube extending direction so that the tube can be retracted only when the barrel is rotated in said other direction and second stop means on said helix engaging the side of said tube upon retraction of said tube to prevent further turning of said helix in tube retracting direction.

2. Writing implement according to claim 1, said first stop means comprising a projection on the lower end of the edge surface of said helix.

3. Writing implement comprising an elongated barrel having open upper and lower ends, an elongated cap having an open lower end and releasably mounted on the upper end of said barrel in axial alignment therewith, a bushing fixed in said cap and having a bore offset from the common axis of said barrel and cap, a pin extending slidably through said bushing and coaxial therewith, a replaceable tube extending slidably through said barrel coaxial therewith and having lower end writing means of the type described, an impeller having a shank extending axially in said cap above said tube and turnable above said axis, said shank having means accessible externally of said cap for manipulation to turn said shank in either direction, said impeller also having a helix depending from said shank coaxially therewith, said helix having an edge surface engaging the upper end of said pin with the lower end of said pin engaging the upper end of said tube, and spring means coupling said tube and said barrel and urging said tube upwardly against the lower end of said pin thereby urging the upper end of said pin against said helix edge, said helix operative upon turning thereof in one direction to extend the lower end of said tube out of said barrel and in the other direction to retract said lower tube end into said barrel.

4. Writing implement according to claim 3, said helix also having first stop means thereon engaging the side of said pin upon extension of said tube to prevent further turning of said helix in tube extending direction and second stop means on said helix engaging the side of said pin upon retraction of said tube to prevent further turning of said helix in tube retracting direction.

5. Writing implement according to claim 3, said pin having a head at the upper end thereof, said helix also having stop means on said helix engaging the side of said pin upon retraction of said tube to prevent further turning of said helix in tube retracting position, and further stop means thereon engaging the side of said pin upon extension of said tube so as normally to prevent further turning of said helix in tube extending direction, said further stop means being cam shaped and positioned relative to said pin head so that upon exertion of extra force for turning of said helix in tube extending direction the further stop means overrides and passes said pin head, said pin and tube then snapping back to retracted position.

6. Writing implement according to claim 4, said first stop means comprising a projection on the lower end of the edge surface of said helix.

7. Writing implement according to claim 5, said further stop means comprising a projection on the lower end of the edge surface of said helix.

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