Dec. 20, 1966 M. D. CHAPMAN ETAL 3,292,592

WRITING INSTRUMENT

Filed Feb. 19, 1963 4 Sheets-Sheet 1

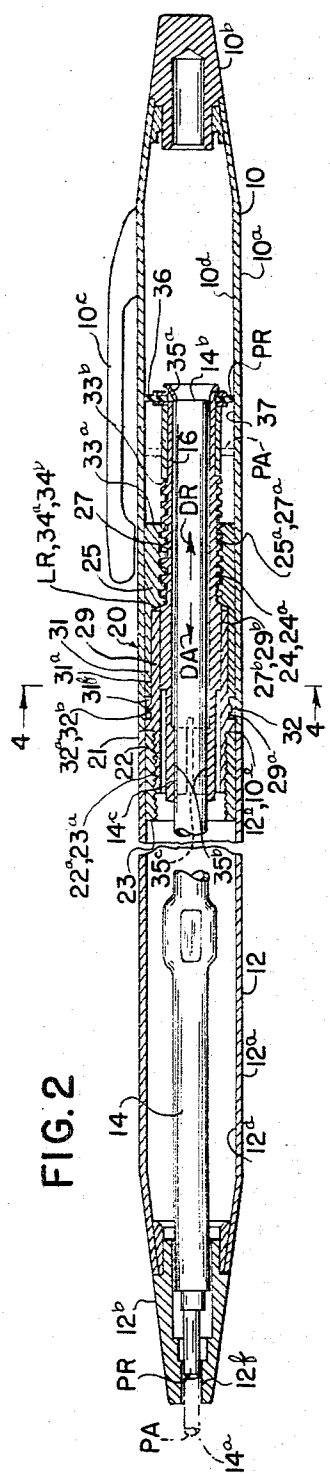


FIG. 2

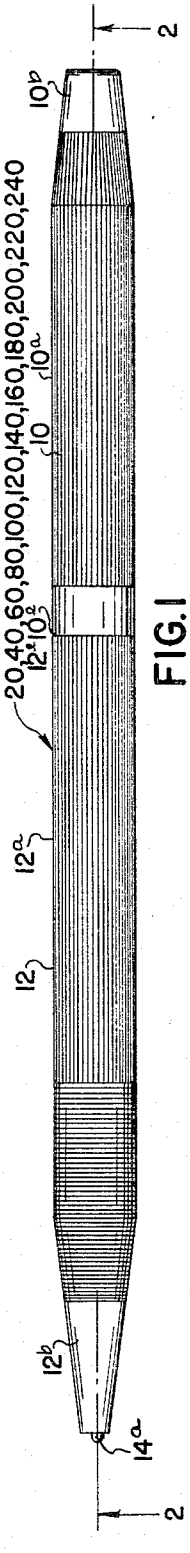


FIG. 1

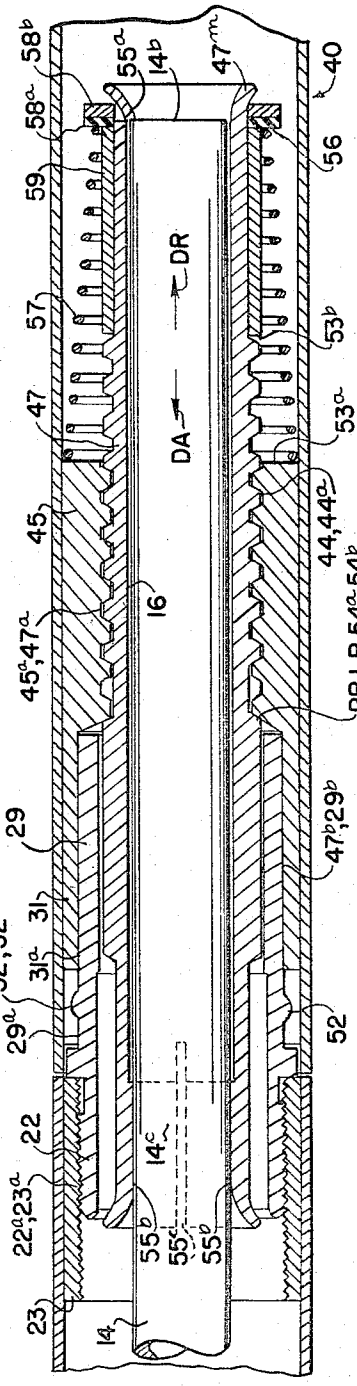


FIG. 5

INVENTORS
MERVIL D. CHAPMAN
BY JOHN J. ORRIS
Jack M. Young
ATTORNEY

Dec. 20, 1966 M. D. CHAPMAN ETAL 3,292,592

WRITING INSTRUMENT

Filed Feb. 19, 1963 4 Sheets-Sheet 2

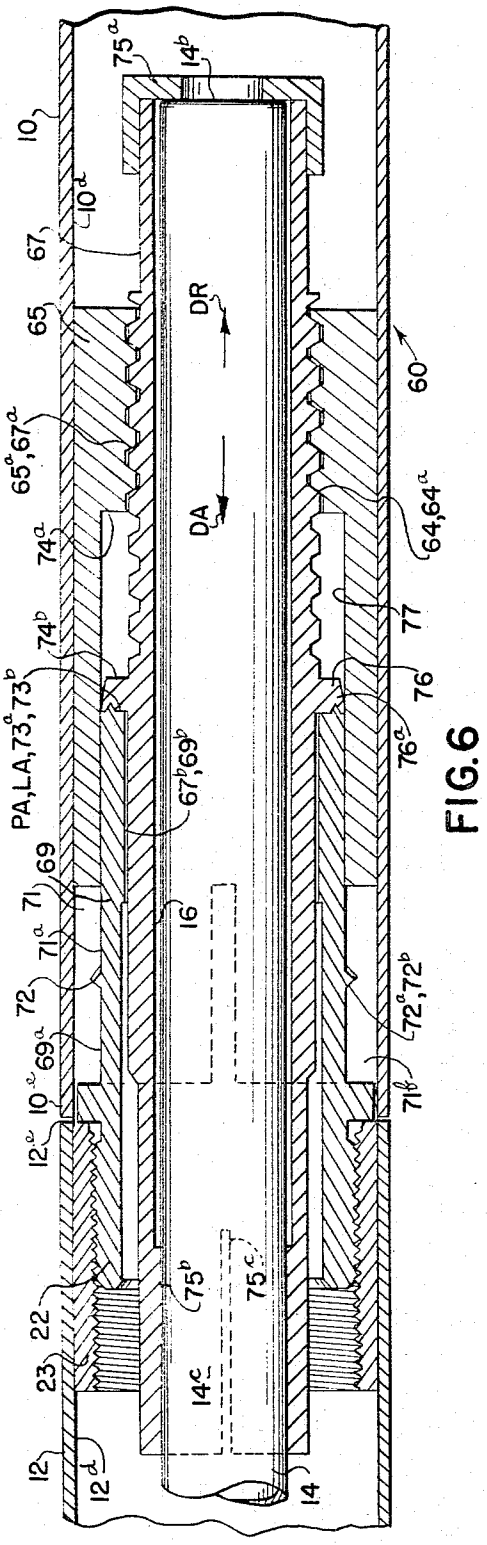


FIG. 6

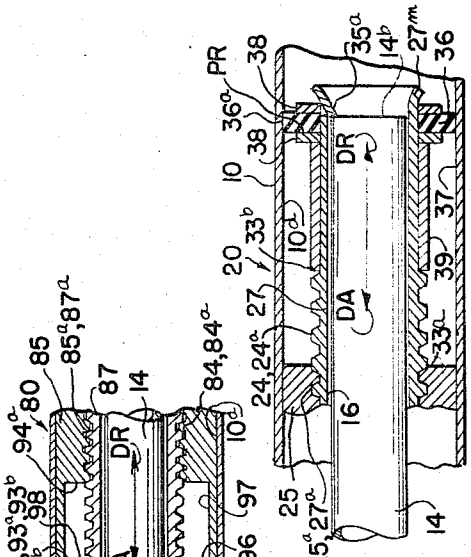


FIG. 3

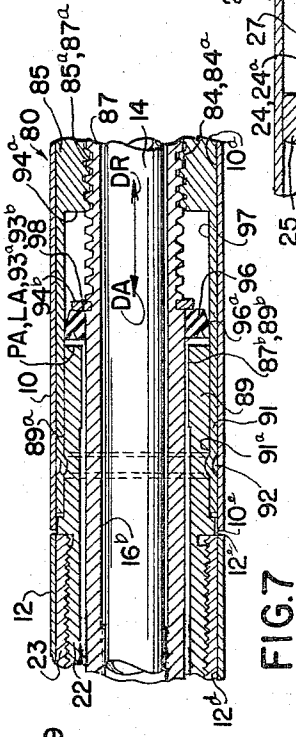


FIG. 7

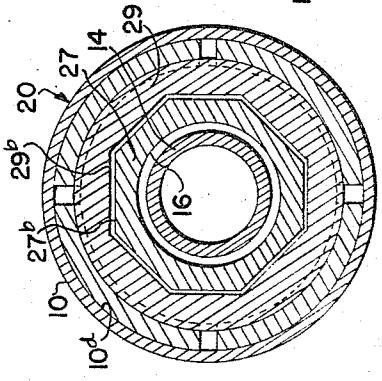


FIG. 4

INVENTORS
MERVIL D. CHAPMAN
BY JOHN J. ORRIS
Jack M. Young
ATTORNEY

Dec. 20, 1966 M. D. CHAPMAN ETAL 3,292,592

WRITING INSTRUMENT

Filed Feb. 19, 1963 4 Sheets-Sheet 3

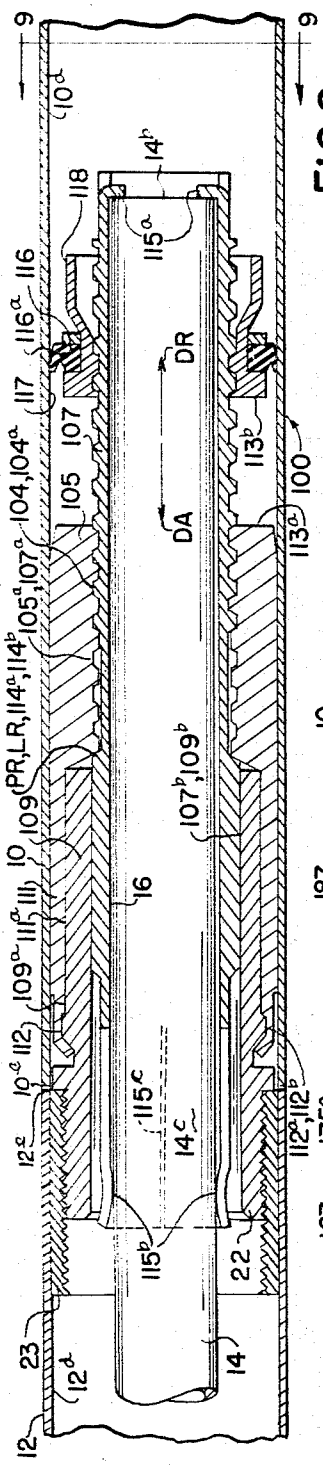


FIG. 8

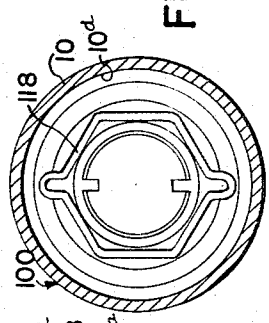


FIG. 9

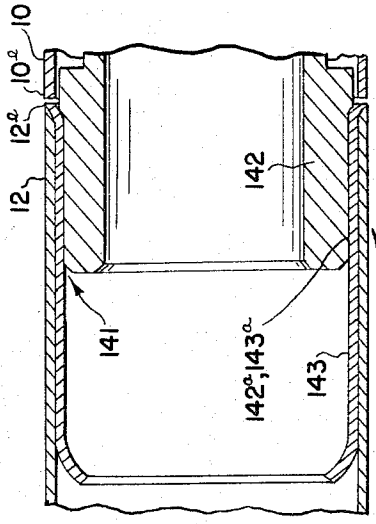


FIG. 11

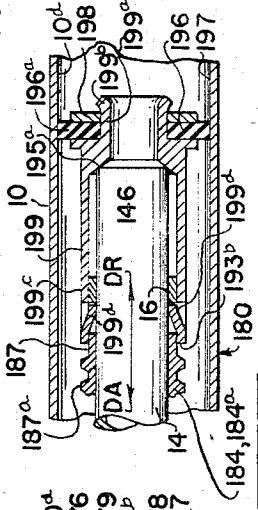


FIG. 13

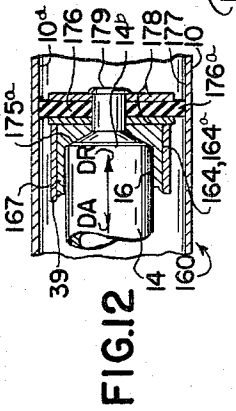


FIG. 12

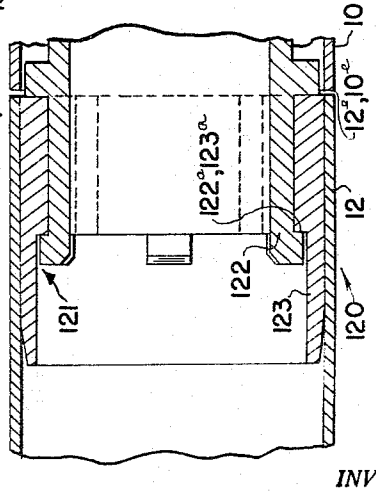


FIG. 10

INVENTORS
MERVIL D. CHAPMAN
BY JOHN J. ORRIS
Jack M. Young
ATTORNEY

Dec. 20, 1966 M. D. CHAPMAN ETAL 3,292,592

WRITING INSTRUMENT

Filed Feb. 19, 1963 4 Sheets-Sheet 4

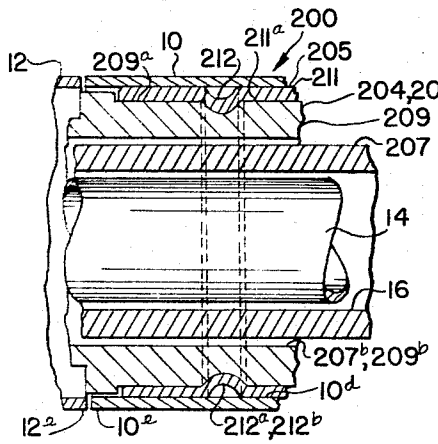


FIG. 14

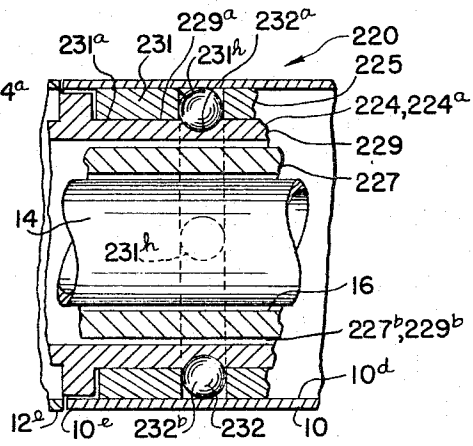


FIG. 15

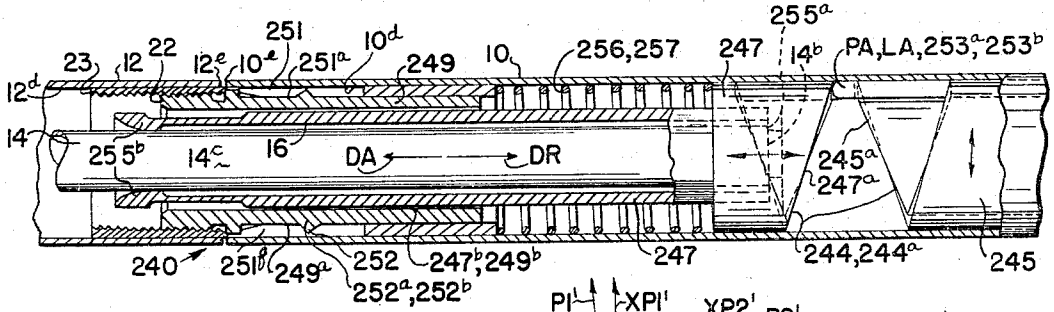


FIG. 16

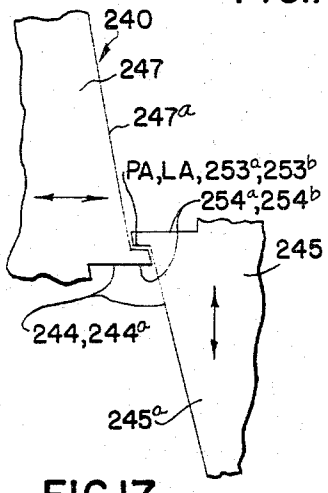


FIG. 17

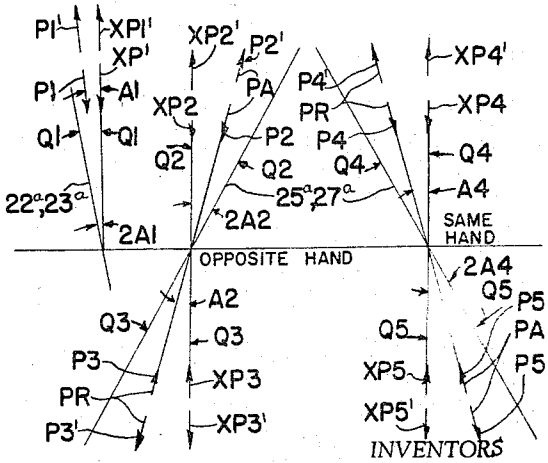


FIG. 18

INVENTORS
MERVIL D. CHAPMAN
BY JOHN J. ORRIS
Jack M. Young
ATTORNEY

United States Patent Office

3,292,592

Patented Dec. 20, 1966

3,292,592

WRITING INSTRUMENT

Mervil D. Chapman, 1403 Dorsch Road, South Euclid, Ohio 44121, and John J. Orris, 1504 Jaeger Drive, Lyndhurst, Ohio 44124

Filed Feb. 19, 1963, Ser. No. 259,570

31 Claims. (Cl. 120—42.03)

The present invention relates to a writing instrument, such as a mechanical pen or pencil, and more particularly to a mechanical pen.

One of the objects of the present invention is to provide a writing instrument constructed to use a standard ball-point pen refill cartridge, to advance or to retract a scribe element by a rotating movement, not only to so move the scribe element but also to couple or uncouple an exterior barrel and cap of the writing instrument by a rotating movement, to permit loading or unloading the scribe element therethrough at generally the mid-portion of the writing instrument, and/or to advance or to retract the scribe element by a positive, part-to-part drive instead of by a frictional drive.

A further object of the present invention is to provide for a writing instrument a plurality of different type couplings for joining the barrel and cap, different type helical drives for advancing or retracting the scribe element, different type connectors in a nut and screw-type scribe element advancing and retracting mechanism, different type drag elements, and/or different type scribe element gripping collets and/or end stops.

A further object of the present invention is to provide a writing instrument characterized by its inexpensive manufacturing cost, ease of assembly of its component parts, structural simplicity, strong and sturdy nature, operating efficiency, low operating cost, attractive exterior appearance, and/or multiplicity of functional advantages for some of its component parts.

These and other objects of the present invention will become more fully apparent by reference to the appended claims as the following detailed description proceeds in reference to the accompanying drawings wherein:

FIG. 1 is a side elevational view of a writing instrument showing a generic view to all forms of the writing instrument disclosed specifically herein as an automatic pen and shown with its scribe element in a partially advanced position short of the writing position;

FIG. 2 is a longitudinal section of the writing instrument in FIG. 1 taken generally along the line **2—2** showing a first form of writing instrument but with the ball point tip shown respectively by dot-dash lines and solid lines in the advanced and retracted positions;

FIG. 3 is an enlargement of a portion of the longitudinal sectional view in FIG. 2;

FIG. 4 is an enlarged, transverse, cross sectional view taken generally along the line **4—4** in FIG. 2;

FIG. 5 is a longitudinal sectional view of a drive mechanism, shown in retracted position, and adapted to be substituted in FIG. 2 for the corresponding drive mechanism therein to make a second form of writing instrument;

FIG. 6 is a longitudinal sectional view of a drive mechanism, shown in advanced position, and adapted to be substituted in FIG. 2 for the corresponding drive mechanism therein to make a third form of writing instrument;

FIG. 7 is a longitudinal sectional view of a drive mechanism, shown in advanced position, and adapted to be substituted in FIG. 2 for the corresponding drive mechanism therein to make a fourth form of writing instrument;

FIG. 8 is a longitudinal sectional view of a drive mechanism, shown in retracted position, and adapted to be substituted in FIG. 2 for the corresponding drive mechanism therein to make a fifth form of writing instrument;

FIG. 9 is a transverse, cross sectional view taken generally along the line **9—9** in FIG. 8;

FIGS. 10 and 11 are longitudinal, sectional views of second and third forms of coupling means adapted to be substituted for the corresponding coupling means in FIG. 2;

FIGS. 12 and 13 are longitudinal sectional views of sixth and seventh forms of drag means, shown in retracted positions, and adapted to be substituted in the drive mechanism in FIG. 2 for the corresponding drag means found there;

FIGS. 14 and 15 are longitudinal sectional views respectively of sixth and seventh forms of connectors adapted to be substituted for any of the other five forms of connectors shown respectively in FIGS. 2 and 5, 6, 7, 8 or 16;

FIG. 16 is a longitudinal sectional view of a sixth form of drive mechanism, shown in advanced position, and adapted to be substituted for the drive mechanism shown in FIG. 2;

FIG. 17 is a circumferential development of the cams and helical surfaces thereon in FIG. 16 shown in advanced position; and

FIG. 18 is a force diagram of the wedge actions at the coupling means and in the helical means, whether the helix is on a screw or on a barrel cam.

A plurality of different forms of writing instruments are disclosed herein but each has the same exterior appearance, as shown in FIG. 1. These are shown, either partially or completely, as different forms of writing instrument **20** in FIGS. 2, 3 and 4; **40** in FIG. 5; **60** in FIG. 6; **80** in FIG. 7; **100** in FIGS. 8 and 9; **120** in FIG. 10; **140** in FIG. 11; **160** in FIG. 12; **180** in FIG. 13; **200** in FIG. 14; **220** in FIG. 15; and **240** in FIGS. 16 and 17. All forms of the invention are generically shown in FIG. 1.

Reference numerals from **10** to **19** have been reserved for common parts found in all forms of the invention; and a set of twenty reference numerals, such as **20** to **39** or **40** to **59**, has been reserved for each form of the invention with the corresponding numbers in all twenty reference number series being applied, whenever possible, to the parts having generally the same function, structure, or mode of operation.

Each form of the invention may serve as any suitable writing instrument, such as not only as the ball point pen specifically illustrated herein but also as the basic structure of a lead pencil or other suitable writing instrument.

Most of the features of all forms of the invention will be generically described at the same time by reference to the first and preferred form shown in FIGS. 2, 3, and 4. Thereafter, the difference between the different forms will be brought out in detail.

The outer shell of pen **20** in FIGS. 2, 3 and 4 includes cap member **10** comprising tubular sleeve **10*a*** having sleeve bore **10*d***, tapered tip **10*b*** pressed or screwed into

one end of sleeve **10***a*, and pocket clip **10***c* secured to the periphery of sleeve **10***a*; barrel member **12** comprising tubular sleeve **12***a* having barrel bore **12***d*, and tapered tip **12***b* pressed or screwed into one end of sleeve **12***a* and having central bore **12***f*; and contiguous ends **10***e* and **12***e* respectively on cap member **10** and barrel member **12**.

Pen **20** may use any suitable form of scribe element **14**, such as a ball point pen refill cartridge or pencil lead. Element **14** is here shown as a ball point pen cartridge having ball point end **14***a*, opposite end **14***b*, and generally cylindrical periphery **14***c* connecting these opposite ends.

Coupling means **21** is movable between an uncoupled or detached position (not shown but with all parts carried by cap **10** completely detached from all parts carried by barrel **12**) and a coupled position shown in FIG. 2 for detachably connecting by a coupling movement contiguous ends **10***e* and **12***e* of cap and barrel members **10** and **12**. Coupling means **21** includes male element **22** carried by cap member **10** and ferrule or female element **23** secured by a force fit in barrel bore **12***d* so that relative rotational and/or telescoping movement applied to the outsides of members **10** and **12** causes corresponding movement of elements **22** and **23** for moving members **10** and **12** between the uncoupled and coupled positions.

Suitable drive mechanism **24** in FIGS. 2 and 3 operatively connects cap and barrel members **10** and **12**.

Mechanism **24** includes drive means **24***a*, responsive to relative rotational movements applied to members **10** and **12** in the coupled position shown in FIG. 2, for advancing (by an advancing movement in direction DA) or retracting (by a retracting movement in direction DR) bore **16** (located within writing instrument **20** and receiving scribe element **14**) and scribe element **14** relative to barrel member **12** between an advanced or writing position PA shown in dot-dash lines in FIG. 2 with ball point end **14***a* projecting out through tip bore **12***f* and retracted position PR shown in solid lines in FIG. 2.

Mechanism **24** includes driver part **25** and driven part **27** respectively having coacting helical surfaces **25***a* and **27***a* respectively rotatable with cap member **10** and barrel member **12** for causing by relative rotation of members **10** and **12** the aforedescribed advancing or retracting movement of said drive means **24***a* in direction DA or DR. The periphery of driver part **25** is rigidly carried by and is secured to cap member **10** by a press fit within bore **10***d* so that no relative axial or rotative movement can take place therebetween.

When cap and barrel members **10** and **12** are rotated, helical surfaces **25***a* and **27***a* cause movement of scribe element **14** in direction DA or DR. In the coupled position shown in FIG. 2, this is true because coupler **29** is operatively carried by barrel member **12**, is rotatably connected to cap member **10** by component **31**, and drives by a keyed connection driven part **27**. Hence, coupler **29** is operatively connected to barrel member **12**, driven part **27** and cap member **10** for the following numbered reasons. First, since one end of coupler **29** is formed by male coupling element **22**, coupler **29** is rigidly carried by barrel member **12** in the aforedescribed coupled position so that neither relative axial nor relative rotative movement can occur therebetween. Second, coupler **29** and driven part **27** are connected by a keyed connection (comprising a telescopically connected, broached, hexagonal bore **29***b* and hexagonal tubing having hexagonal outer surface **27***b* but able to take the form of any other type suitable keyed or splined connection) permitting axial relative sliding movement of part **27** within coupler **29** in advancing direction DA and retracting direction DR but preventing relative rotative movement. Third, rotatable component **31** is secured by a press fit within cap bore **10***d* against relative axial and rotative movement. Coupler **29** has peripheral surface **29***a* and component **31** has bore surface **31***a* providing coacting relatively rotatable and telescoped surfaces forming connection **32** to rotatably connect them together while preventing substantial axial relative movement between them.

Although component **31** and driver part **25** are shown as a one-piece part and male element **22** and coupler **29** are shown as a one-piece part in FIG. 2, it should be readily apparent that either or both one-piece parts may be split into two parts, either directly connected together or through an intermediate part. For example, compare one-piece part **25**, **31** in FIG. 2 with the comparable part in FIG. 16 comprising driver part **245** and component **251** rigidly joined together by barrel sleeve **10***a*.

As driven part **27** moves in either advancing direction DA or retracting direction DR relative to driver part **25**, it reaches at the end of its travel either advanced position PA or retracted position PR. These positions PA and PR are respectively defined by end stops **33***a*, **33***b* and **34***a*, **34***b* with stops **33***a* and **34***a* being located on part **25** and stops **33***b* and **34***b* being located on part **27**. These end stops **33***a*, **33***b* and **34***a*, **34***b* are respectively engageable in advanced and retracted positions PA and PR to define different stop engaged positions LA and LR by the wedging action between these parts **25** and **27** caused by helical surfaces **25***a* and **27***a*. As will be brought out in more detail hereafter, helical surfaces **25***a* and **27***a* and coupling means **21** are constructed so that scribe element **14** can easily move between positions PA and PR because these helical surfaces **25***a* and **27***a* are always unlockable from these locked positions LA and LR during relative rotation of cap and barrel members **10** and **12** without uncoupling coupling means **21**.

An inspection of the drawings will reveal that the description of the structural parts, directions, positions and mode of operation for FIGS. 2, 3, and 4 in the preceding paragraphs apply generically to the same named parts, directions, positions and modes of operation correspondingly numbered in a different twenty reference number series in FIGS. 5–17, inclusive.

Now, the structural differences between the different forms of the invention will be brought out in the following paragraphs. Note that the similarly named component parts in each drive mechanism, etc. have generally the same function and mode of operation so are interchangeable, either directly or with some modification. Hence, the scope of the present invention includes not only the combinations illustrated but other combinations where the last mentioned component parts are combined in different manners.

Three different type coupling means **21**, **121** and **141** are shown respectively in drawing FIGS. 2, 5–8 and 16; 10; and 11 as having male coupling elements **22**, **122**, and **142** carried by cap member **10** and female coupling elements **23**, **123** and **143** carried by barrel member **12**. In FIGS. 2, 5–8 and 16, threads **22***a* and **23***a* on elements **22** and **23** have helical surfaces providing the coupling action by relatively rotating cap and barrel members **10** and **12**. In FIG. 10, elements **122** and **123** have two rotatable and connectable bayonet surfaces **122***a*, **123***a* adapted to be locked together by a sequential telescopic assembly and rotatable action of barrel **12** and cap **10** to the coupled position. Elements **122** and **123** will be securely locked in coupled position if elements **122** and **123** are either composed of resilient molded plastic material so as to spring lock together or, if made of metal, have a resilient annular washer (not shown) located between elements **122** and **123** generally coplanar with the space betwen contiguous ends **10***e* and **12***e*. It should be apparent that both threads **22***a*, **23***a* and bayonet surfaces **122***a*, **123***a* have a rotatable wedge-type coupling surface coupling cap and barrel members **10** and **12** together in coupled position. In FIG. 11, coupling elements **142** and **143** respectively have two, cylindrical, telescopically and/or rotatably connectable surfaces **142***a* and **143***a* having a snug, friction fit to provide a push-type and/or rotatable-type coupling action and a pull-type and/or rotatable-type uncoupling action.

The driver parts and driven parts, and the helical surface on each, for causing advancing and retracting movement in directions DA and DR may take different forms. Driver parts or nuts **25**, **45**, **65**, **85** and **105** respectively in FIGS. 2–4, 5, 6, 7 and 8–9 and driven parts or screws **27**, **47**, **67**, **87**, **107** and **187** in FIGS. 2–4, 5, 6, 7, 8–9 and 13 have helical surfaces **25***a*, **45***a*, **65***a*, **85***a* and **105***a* and **27***a*, **47***a*, **67***a*, **87***a*, **107***a* and **187***a* formed by screw threads. In FIGS. 16–17, driver part or cam actuator **245** and driven part or cam **247** are respectively rear and front barrel cams having helical surfaces **245***a* and **247***a*.

Each driven part has a suitable bore **16** permitting removal of, or for telescopically receiving, scribe element **14** by insertion through cap end **10***e* when cap and barrel members **10** and **12** are in the uncoupled position. Each bore **16** securely holds and locates scribe element **14** in the coupled position in the different writing instruments in many different manners. Each driven part **27**, **47**, **67**, **87**, **107**, **167**, **187**, **207**, **227** and **247** is sleeve-like in shape; has or is intended to have an end stop located on the end of the bore most remote from the writing end of scribe element **14** to engage scribe element end **14***b* for preventing writing pressure on ball point end **14***a* from causing appreciable axial movement of element **14** into barrel member **12** and bore **16** from advanced position PA; and has a collet, having a bore diameter less than the rest of bore **16** and located at the end of bore **16** closest writing end **14***a* of scribe element **14**, for gripping scribe element **14** in the advanced and coupled positions. Some of the different forms of end stops illustrated include respectively in FIGS. 2, 3 and 5 portions **35***a* and **55***a* of the wall of the driven part bent inwardly over the remote end of bore **16** so that this portion is located to engage remote end **14***b* of scribe element **14**; in FIG. 6 cap **75***a* telescoped over and secured to the remote end of driven part **67**; in FIG. 8 diametrically aligned lug portions **115***a* of the wall of driven part **107** bent inwardly over the remote end of bore **16** so that these portions **115***a* engage remote end **14***b* of scribe element **14**; and in FIGS. 12, 13 and 16 bore bottoms **175***a*, **195***a* and **255***a* carried by driven parts **167**, **187** and **247** respectively. The collets shown in FIGS. 2, 5, 6, 8, and 16 have portions **35***b*, **55***b*, **75***b*, **115***b* and **255***b* with bore diameters less than the rest of each bore **16** to grip scribe element periphery **14***c* by either the resiliency of the material, as shown in FIG. 16, or by axially extending and equally circumferentially spaced apart splits in the last mentioned portions in the sleeve-like driven part, as shown by splits **35***c*, **55***c*, **75***c* and **115***c*, or any combination of resiliency and splits.

The rotatable connections **32**, **52**, **72**, **92**, **112**, **212**, **232** and **252** respectively in FIGS. 2, 5, 6, 7, 8, 14, 15 and 16 between couplers **29**, **29**, **69**, **89**, **109**, **209**, **229** and **249** and associated rotatable components **31**, **31**, **71**, **91**, **111**, **211**, **231**, and **251** may take many different forms. Connections **32**, **52**, **72**, **112** and **252** respectively include annular grooves **32***a*, **52***a*, **72***a*, **112***a* and **252***a* in bore surfaces **31***a*, **51***a*, **71***a*, **111***a* and **251***a* and annular rings **32***b*, **52***b*, **72***b*, **112***b* and **252***b* on peripheral surfaces **29***a*, **29***a*, **69***a*, **109***a* and **249***a*; and connections **92**, **212** and **232** include annular grooves **92***a*, **212***a* and **232***a* in peripheral surfaces **89***a* and **209***a* and annular rings **92***b* and **212***b* in bore surfaces **91***a* and **211***a* coacting together to provide relative rotative movement but to prevent relative axial movement between the coupler and its associated driver part. Grooves **32***a* and **52***a* and rings **32***b* and **52***b* have coacting surfaces forming an arc of a circle cut in each of the surfaces; and grooves **72***a* and **252***a* and rings **72***b* and **252***b* being triangular in cross section.

Prior to telescopic insertion into barrel cap bore **10***d*, each associated coupler and rotatable component is assembled together. In FIGS. 2, 5, 6 and 16 respectively, rotatable components **31**, **31**, **71** and **251** and their bores **31***a* **31***a*, **71***a* and **251***a* have diametrically aligned axially extending splits **31***f*, **71***f* and **251***f* for permitting telescopic assembly of each rotatable component over its associated coupler by having the split portions spring outwardly during travel over the associated rings. In FIGS. 7 and 14, rings **92***b* and **212***b* are contour roll formed into grooves **92***a* and **212***a* after telescopic assembly of coupler **89** and **209** and components **91** and **211**. In FIG. 8, component **111** has a cylindrical counterbore formed at the left end of bore surface **111***a*, ring **112***b* is telescoped into location in this counterbore, and the left end of this counterbore is spun inwardly and axially down onto one side of ring **112***b* to form groove **112***a* over ring **112***b*. In FIG. 15, peripheral surface **229***a* on coupler **229** has therein annular groove **232***a*, bore surface **231***a* has four radially extending and equally circumferentially spaced apart holes **231***h* in axial alignment with groove **232***a*, and four balls **232***b*, one located in each hole **231***h* and in radial alignment between annular groove **232***a* and cap member bore **10***d*.

Each form of writing instrument illustrated has structure providing a frictional drag action during advancing and retracting movements in directions DA and DR to take up any lost motion, to stop any "free wheeling," and to stop any "runaway action" in the component parts. Two different type drag actions are provided, as described in the following paragraphs.

First, FIGS. 2 and 3, 6, 7, 8, 12 and 13 show respectively drag means **36**, **76**, **96**, **116**, **176** and **196** carried by driven parts **27**, **67**, **87**, **107**, **167** and **187**; and having drag rings **36***a*, **76***a*, **96***a*, **116***a*, **176***a* and **196***a* engaging during movement in directions DA or DR by a frictional drag action cylindrical surfaces **37**, **77**, **97**, **117**, **177** and **197** fixed against axial relative movement relative to driver parts **25**, **65**, **85** and **105** (driver parts not shown in FIGS. 12 and 13) by being either on said last-mentioned part, such as on driver part **65** in FIG. 6 and part **85** in FIG. 7, or on another component fixed relative thereto, such as on cap bore surfaces **10***d* in FIGS. 2, 3, 8, 12 and 13. Each such drag ring may be made of any suitable resilient material, such as felt, rubber, plastic, etc.

FIGS. 2 and 3, 6, 7, 8, 12 and 13 show different specific constructions. In FIGS. 2 and 3, drag means **36** has drag ring **36***a* straddled by two washers **38** and axially located between spun over end **27***m* on driven part **27** and sleeve **39** abutting against the right end of threads **27***a*. In FIG. 6, drag means **76** has drag ring **76***a* formed integral with driven part **67**. In FIGS. 7 and 8, drag means **96** has drag ring **96***a*, and drag means **116** includes drag ring **116***a* telescopically connected respectively over driven parts **87** and **107** with each drag ring having an annular groove, generally triangular in cross section, in one axial face thereof. In FIG. 7, drag ring **96***a* and driven part **87** have respectively frictionally contacting bore and peripheral surfaces, and drag ring **96***a* is held against axial movement in one direction by C-snap ring **98** located in a groove in the periphery of driven part **87**. In FIG. 8, drag means **116** includes annular carrier **118** telescopically located between drag ring **116***a* and driven part **107** and being swedged at assembly, as shown in FIG 9, to lock it against rotation and axial movement on threads **107***a*. FIG 12 has drag means **176** including drag ring **176***a* straddled by washers **178** and connected to the end of driven part **167** by rivet **179** telescoped through aligned holes in drag ring **176***a*, washers **178** and driven part **167**. In FIG. 13, drag means **196** includes drag ring **196***a* telescoped over sleeve **199***a* on sleeve-like carrier **199** and secured thereon by washer **198** and sleeve end **199***b* spun over at assembly. Opposite end **199***c* of carrier **199** is telescopically connected over the right end of driven member **187** and has ears **199***d* pushed inwardly during assembly into aligned holes in driven member **187**.

Second, drive mechanism **44** in FIG. 5 and **244** in FIG. 16 includes drag means **56** and **256** comprising respectively helical compression springs **57** and **257** axially pushing parts **45**, **47** and **245**, **247** and their helical surfaces **45***a*, **47***a* and **245***a*, **247***a* axially together to provide

a frictional drag action during advancing or retracting movement in direction DA or DR. These helical surfaces are screw threads **45***a*, **47***a* in FIG. 5 and cam surfaces **245***a*, **247***a* on coacting barrel cams in FIG. 16. In FIG. 5, the right hand end of spring **57** bears against washers **58***a*, **58***b* axially located between spun over end **47***m* on driven part **47** and sleeve **59** abutting against the right hand end of threads **47***a*. Washers **58***a* and **58***b* are preferably made of different materials to avoid any jumpy drive action caused by differences in friction caused when washers made of the same material try to rotate relative to each other. If washer **58***b* is made of steel, washer **58***a* is preferably made of neoprene, rubber, oil soaked felt, fiber, cardboard, etc. to give a smooth drive action.

An examination of the drawings will reveal in FIGS. 2–4, 5, 6, 7, 8–9, and 16 respectively that advanced positions PA are defined by engagement of end stops **33***a* and **33***b* respectively on driver part **25** and on sleeve **39** carried by driven part **27**; **53***a* and **53***b* respectively on driver part **45** and on sleeve **59** carried by driven part **47**; **73***a* and **73***b* respectively on coupler **69** and drag ring **76***a* carried by driven part **67**; **93***a* and **93***b* respectively on coupler **89** and drag ring **96***a* on driven part **87**; **113***a* and **113***b* respectively on driver part **105** and carrier **118** on driven part **107**; and **253***a* and **253***b* respectively on driver part **245** and driven part **247** and that retracted positions PR are defined by engagement of end stops **34***a* and **34***b* respectively on driver part **25** and driven part **27**; **54***a* and **54***b* respectively on driver part **45** and driven part **47**; **74***a* and **74***b* respectively on driver part **65** and drag ring **76***a* carried by driven part **67**; **94***a* and **94***b* respectively on driver part **85** and snap ring **98** on driven part **87**; **114***a* and **114***b* respectively on driver part **105** and driven part **107**; and **254***a* and **254***b* respectively on driver part **245** and driven part **247**. The drag means **176** and **196** in FIGS. 12 and 13 are adapted to be substituted for the drag means **36** and **116** in FIGS. 3 and 8 so have the same end stops except end stop **193***b* in FIG. 13 is then used in place of end stop **113***b* in FIG. 8.

Pens **20** and **160** in FIGS. 2, 3 and 12 are constructed so that the parts are automatically locked in advanced position PA. Consider FIG. 3 as an example. Sleeve **39**, drag ring **36***a* and washers **38** are telescopically connected over and axially movable relative to driven part **27**. Drag ring **36***a* and washers **38** are axially located between spun over end or stop **27***m* and the right end of sleeve **39**. As driven part **27** moves in advancing direction DA into writing or advanced position PA, the left end of sleeve **39** engages as end stop **33***b* against driver part **25** as end stop **33***a* to push sleeve **39** over driven part **27** toward stop **27***m* for radially squeezing or deforming resilient drag ring **36***a* outwardly into a frictionally locked, advanced position pushed outwardly against cylindrical surface **37**.

Although different methods of assembly may be used for each pen illustrated here in the drawings, a brief description of one suitable assembly method for pen **20** in FIGS. 2 and 3 will illustrate the principles involved. Ferrule **23**, tip **10***b* and tip **12***b* are telescopically press fitted into the appropriate cap **10** or barrel **12**. Driver member **25** is axially telescoped toward the left over rotatable component **29**, axial splits **31***f* are forced open by ring **32**, and groove **32***a* and ring **32***b* snap assembled to form a unit then telescoped in the left hand direction over driven part **27**. After assembly is completed by telescoping together hexagonal surfaces **27***b* and **29***b* and by screwing threads **25***a* and **27***a* together, sleeve **39**, washers **38** and drag ring **36***a* are telescoped over the right end of driven member **27** and end **27***m* is spun over to complete this unit. Then, this unit is telescoped axially toward the right through cap end **10***e* into cap bore **10***d* within which the left end of the periphery of component **29** fits with a press fit to at least partially close up splits **31***f* and cause them to grip bore **10***d* tightly.

It should be readily apparent that each of the aforedescribed members, parts, elements, components, couplers, etc. other than the drag rings and helical springs may be made from any suitable material, such as plated or unplated brass; aluminum; molded plastic, such as such as nylon; etc.

Since each form of writing instrument disclosed herein operates in generally the same manner, the method of operation of only pen **20** in FIGS. 1–4 will be described here. A replacement can be made for scribe element **14** when cap **10** and barrel **12** are in uncoupled position (completely detached at ends **10***e* and **12***e*). Then, scribe element **14** can be axially pulled out of bore **16** through cap end **10***e* and a replacement element **14** can be inserted in bore **16** until it bottoms against end stop **35***a* in FIG. 3. Now, the movements will be sequentially described for moving pen **20** to coupled position, for moving scribe element **14** between retracted and advanced position PR and PA, and for moving cap **10** and barrel **12** to uncoupled position. During all of these movements all screw threads **22***a*, **23***a*, **25***a* and **27***a* have some relative movement. For purposes of illustration, let us say that threads **22***a* and **23***a* are ¼ inch-56 pitch, single lead right hand threads and that threads **25***a* and **27***a* are #10–24 pitch, double lead, left hand threads, which are the specific threads used in a working model of pen **20**.

These sequential movements are relative rotation of cap **10** and barrel **12**: (1) in a first direction to move members **10** and **12** from uncoupled to coupled positions, (2) in either opposite directions in this coupled position by only a scribe element actuating force to move scribe element **14** between advanced position PA and retracted position PR defining scribe element end positions without uncoupling members **10** and **12**, or (3) in the opposite of the said first direction in one of the scribe element end positions, PR or PA, by an uncoupling force greater than the scribe element actuating force to move members **10** and **12** to the uncoupled position. In the specific thread example given with the threads being of opposite hand, the movements in the aforesaid first and in the first of the opposite directions are sequential movements in the same direction first coupling members **10** and **12** and then moving scribe element **14** to advanced position PA. To understand the sequence of these movements more clearly, assume that the components of pen **20** start in the solid line position shown in FIG. 2. Then, relative rotation of cap **10** and barrel **12**: (1) in the first direction will cause cap **10** to directly screw threads **22***a* onto threads **23***a* by a rigid drive from cap **10** through component **31**, driver part **25**, threads **25***a* and **27***a* rigidly locked against axial movement by engaged retracted position end stops **34***a* and **34***b*, and hexagonal surfaces **27***b* and **29***b* to coupling threads **22***a*; (2) in the same direction so that further rotation of barrel **10** in the same direction sequentially unlocks end stops **34***a* and **34***b* and rotates drive part **25** on driven part **27** to advance part **27** and scribe element **14** in advancing direction DA from retracted position PR shown in solid lines in FIG. 2 to advanced position PA shown in dot-dash lines where end stops **33***a* and **33***b* engage and lock up while the hexagonal surfaces **27***b* and **29***b* prevent rotation of driven part **27** with driver part **25**; (3) in the opposite direction sequentially to unlock in position PA end stops **33***a* and **33***b* and to move driven part **27** and scribe element **14** in retracting direction DR from advanced position PA to retracted position PR through drive mechanism **24** in the same manner until end stops **34***a* and **34***b* again lock up, as shown in solid lines in FIGS. 2; or (4) in the opposite of said first direction with end stops **33***a* and **33***b* locked up in retracted position PR by an uncoupling force exerted from barrel **10** through component **31**, driver part **25**, threads **25***a*

and **27***a* rigidly locked against axial movement by engaged retracted position end stops **34***a* and **34***b*, and hexagonal surfaces **27***b* and **29***b* to coupling threads **22***a*.

To have this mode of operation, threads **22***a*, **23***a* in coupling means **21** and threads **25***a* and **27***a* must have a definite relationship. Since this same relationship can exist for any form of the pens shown in FIGS. 1–17, let us consider the relationship broadly for all. Note we have to consider: (1) three different type coupling means **21** in FIG. 2, **121** in FIG. 10, and **141** in FIG. 11; and (2) two different type helical surfaces, including threads **25***a* and **27***a* in FIGS. 2 and 3 and cam surfaces **245***a* and **247***a* in FIGS. 16 and 17.

To establish the necessary relationship, the helical surfaces and coupling means in any one of these writing instruments must be constructed so that, during relative rotation of members **10** and **12** in the coupled position, any of the following factors are true: (1) the rotatable gripping force by lock up at any such coupling means is greater than the rotatable gripping force by lock up at the coarse actuating threads **25***a*, **27***a*; (2) the helical surfaces **25***a*, **27***a* and **245***a*, **247***a* are always unlockable by relative rotation of members **10** and **12** without uncoupling any such coupling means; (3) coarser threads **25***a*, **27***a* must be able to unlock without unlocking finer threads **22***a*, **23***a*; (4) any such coupling means is frictionally snug enough in the direction of relative rotation of members **10** and **12** in the coupled position for permitting at all times relative sliding movement between helical surfaces **25***a*, **27***a* and **245***a*, **247***a* in either advancing or retracting directions DA or DR but free enough to be uncoupled by an uncoupling force whenever desired; or (5) the lead on the helical surfaces **25***a*, **27***a* and **245***a*, **247***a* is greater than the lead on any helical surfaces of any coupling (such as on threads **22***a* and **23***a* on coupling means **21**) so that not only scribe element **14** can be advanced and retracted rapidly but also coupling means **21** has the aforesaid frictionally snug but free enough characteristics.

If not only the drive means but also the coupling means has helical surfaces, this relationship may be mathematically expressed by use of the scientifically established wedge formula describing the lock up action at all helical surfaces, such as for example between threads **22***a*, **23***a* and threads **25***a*, **27***a*. Although four possible conditions can exist by different combinations of right and left hand threads of the same or different hands, they are all graphically illustrated in FIG. 18 by (reading from left to right) threads **22***a*, **23***a* having thread helix angle **2A1**; threads **25***a*, **27***a* having helix angle **2A2** and having a hand opposite threads **22***a*, **23***a*; and threads **25***a*, **27***a* having helix angle **2A2** and having the same hand as threads **22***a*, **23***a*. In each of the five V-vertices in FIG. 18, there is an unprimed P force driving the thread wedge together and a primed P force pulling the thread wedge apart at each locked position. Since threads **25***a*, **27***a* jam or lock up against straddling right angle shoulders defining positions PA and PR, each diagram for threads **25***a*, **27***a* has one lock up position above and the other lock up position below the horizontal line and designated either advanced position PA or retracted position PR.

Before examining the wedge formula let us first consider the action with threads of opposite hand and second with the threads of the same hand in FIGS. 2 and 3. First, if threads **22***a*, **23***a* are right hand and threads **25***a*, **27***a* are left hand threads so as to be of opposite hands. the sequence of movements and wedge actuating forces are as follows if we start with members **10** and **12** in uncoupled position and scribe element **14** *in retracted position PR:* (1) members **10** and **12** are moved into and locked in coupled position by force **P1** exerted in one direction (downward in FIG. 18); (2) further movement in this same one direction uncouples end stops **34***a*, **34***b* in position PR by force **P3′** until force **P2** locks up end stops **33***a*, **33***b* in position PA; (3) movement in the opposite direction (upward in FIG. 18) unlocks by force **P2′** end stops **33***a*, **33***b* in position PA; (4) further movement in this opposite direction locks up end stops **34***a*, **34***b* by force **P3** in retracted position PR; and (5) further movement in this opposite direction uncouples threads **22***a*, **23***a* by force **P1′**. Second, if threads **22***a*, **23***a* and **25***a*, **27***a* are of the same hand, the sequence of movements and wedge actuating forces are as follows if we start with members **10** and **12** in uncoupled position and scribe element **14** *in advanced position PA:* (1) members **10** and **12** are moved into coupled position by force **P1** exerted in the same one direction (downward in FIG. 18); (2) further movement in this same one direction uncouples end stops **33***a*, **33***b* in position PA by force **P5′** until force **P4** locks up end stops **34***a*, **34***b* in position PR; (3) movement in the opposite direction (upward in FIG. 18) unlocks by force **P4′** end stops **34***a*, **34***b* in position PR; (4) further movement in this opposite direction locks up end stops **33***a*, **33***b* by force **P5** in advanced position PA; and (5) further movement in this opposite direction uncouples threads **22***a*, **23***a* by force **P1′**.

Now, it should be noted that the five different "necessary relationships" set forth in the third preceding paragraph must exist between wedge opening forces **P1′** and **P2′** in position PA for threads of opposite hand and between wedge opening forces **P1′** and **P4′** in position PR for threads of the same hand.

Now, let us consider the scientific wedge formula. This formula sets forth the wedge forces acting on each screw thread at lock up as follows:

$$P=2Q(f\cos A+\sin A)$$

if the reference numeral suffixes in each of the five V-diagrams in FIG. 18 are ignored. Prime suffixes designate the reversed or negative forces in the formula for unlocking each wedge at uncoupling position or position PA or PR, and prefix "X" has been added to designate the cosine component of force P exerted by relative rotation of cap **10** and barrel **12**. Then, the aforedescribed relationship requires for threads of the same hand:

$$xP4'<xP1'$$

and for threads of different hands:

$$xP2'<xP1'$$

so that the rotatable unlocking force at threads **25***a*, **27***a* is less than the rotatable unlocking force at threads **22***a*, **23***a*. When the wedge formula is substituted in the last two equations with the cosine components of the P forces, these relationships become the following general formula:

$$Q(f\cos A+\sin A)\cos A<Q1(f1\cos A1+\sin A1)\cos A1$$

wherein A, *f*, and Q apply to the characteristic of any thread **25***a*, **27***a* having in FIG. 18 suffix 2, 3, 4 or 5 and being either primed or unprimed. It should be noted that suffix "1" refers to wedge-type coupling surfaces **22***a*, **23***a*; the remaining factors refer to helical surfaces **25***a*, **27***a*; *f* is the coefficient of friction of the selected threads; 2A is the helix angle of the selected threads; Q are the forces acting on the sides of the selected thread wedge; and P is the force driving the selected thread wedge into locked position. It is believed that as long as this relationship exists, the locking and unlocking action will occur properly.

Note that the coefficient of friction *f* on each pair of threads depends upon the metallic or non-metallic materials composing, and any plating thereon, the coacting threaded parts.

Although this formula has been derived and the aforedescribed five necessary relationships have been explained only for threads **22***a*, **23***a*, **25***a* and **27***a*, it should be apparent that this same formula applies when threads **25***a*, **27***a* are replaced by cam surfaces **245***a*, **247***a*; or threads **22***a*, **23***a* are replaced by bayonet surface **122***a*, **123***a* in

FIG. 10, if such surfaces lock by a wedging action. Of the aforedescribed five necessary relationships, Nos. (1) and (4) apply for any coupling means **121** or **141** in FIG. 10 or 11 used, with or without a wedging action. Then the afore-mentioned formula becomes:

$$Q(f \cos A + \sin A) \cos A < F$$

wherein F is the rotatable uncoupling force and the other factors are the same as before.

It is preferred that threads **22***a*, **23***a* be right hand threads; threads **25***a*, **27***a* be left hand; and the threads thus be of opposite hand for the following numbered reasons. First, the directions of rotation of cap **10** relative to barrel **12** to move scribe element **14** in advancing direction DA and in retracting direction DR are the same as in the conventional lead pencil. Second, the movements of coupling threads **22***a*, **23***a* and of advancing scribe element **14** in direction DA from retracted position PR to writing position PA are sequential rotations in the same directions, and the movements of retracting scribe element **14** in direction DR from writing position PA to retracted position PR and of uncoupling threads **22***a*, **23***a* are sequential movements in the opposite direction. Hence, minimum change of direction of movement, and smoothest and most natural operation, always puts scribe element **14** in the proper writing position PA, retracted position PR, uncoupled position for replacing element **14**, or coupled position for pen useage. Third, the scribe element bore and the end of the driven part (such as bore **16** and the left end of driven part **27** in FIG. 2) will always be located in retracted position PR, when members **10** and **12** are in uncoupled position, so as to project the minimum distance from the outer end of coupling element **22** and cap **10** so as to provide then the most attractive appearance. Compare these features with those found in the aforedescribed operation of threads of the same hand; in a pen where threads **22***a*, **23***a* are left hand threads and threads **25***a*, **27***a* are right hand threads; or in the prior art.

Here are some of the advantages of the different forms of writing instruments disclosed herein and illustrated in drawing FIGS. 1–17. First, any standard type ball point pen refill cartridge or element **14** can be used. Second, each writing instrument is of simple construction and has few component parts. Third, the user loads scribe element **14** through the middle of each writing instrument between contiguous ends **10***e* and **12***e*, instead of through one end of the writing instrument. Fourth, each writing instrument is attractive and distinctive in appearance. Fifth, each writing instrument uses a relative rotating movement of cap **10** and barrel **12** to advance and retract scribe element **14** and/or to couple or uncouple cap **10** and barrel **12** during replacing or changing of scribe elements **14** therein. Sixth, for a given arcuate relative rotation of cap **10** and barrel **12**, each writing instrument has greater axial movement by said advancing and retracting movements movable in directions DA and DR than by the coupling and uncoupling action, whereby scribe element **14** is quickly moved to any position PA or PR desired. This is true because, for example in FIG. 1, the lead of threads **25***a*, **27***a* is greater than threads **22***a*, **23***a*. Seventh, relatively rotating cap **10** and barrel **12** causes movement of scribe element **14** in direction DA or DR and/or causes coupling or uncoupling of cap **10** and barrel **12** by a positive drive (including press fits between cap **10**, barrel **12** and their associated drive mechanism) instead of relying on frictional drive, friction slippage or a slip fit drive. Eighth, each writing instrument has a drive mechanism adapted to be readily used with any type scribe element **14**, whether ball point pen or mechanical pencil lead. Ninth, each writing instrument has all of the relatively movable components in its drive mechanism assembled together into an assembly pressed into cap **10** so as: (1) to be locked therein with no possibility of disassembly in any position, (2) to be approximately flush with cap end **10***e* and barrel end **12***e*, except for projecting threads **10***a*, in uncoupled position to provide an attractive appearance, and (3) to permit relative opposite directions of rotations of cap **10** and barrel **12** not only to move scribe element **14** in advancing and retracting direction DA and DR but also to move cap **10** and barrel **12** between coupled and uncoupled positions.

This invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive with the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by U.S. Letters Patent is:

1. A writing instrument, comprising

(a) a cap member,

(b) a barrel member connected to said cap member,

(c) coupling means for detachably connecting said members with the members movable between uncoupled and coupled positions, and

(d) drive mechanism operatively secured in at least one of said members,

(e) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(f) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced and a retracted position,

(g) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(h) said driver part being rigidly carried by said one member by a press fit,

(i) a coupler operatively carried by said other member in said coupled position,

(j) said driven parts being axially slidable in said coupler,

(k) whereby advancing and retracting movement of said scribe element by relative rotational movement of said members is a positive drive not relying on frictional slippage.

2. An assembly comprising a drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position with the other of said members in said coupled position closing said uncoupled end on said one member,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a coupling means as described,

(f) said helical surfaces and said coupling means being constructed so that said helical surfaces are operably unlockable during relative rotational movement of

said barrel and cap members without uncoupling said coupling means.

3. An assembly comprising a drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a coupling means as described,

(f) said parts having end stops respectively engageable in said advanced and retracted positions to define locked positions by the wedging action between said parts caused by said helical surfaces,

(g) said helical surfaces and said coupling means being constructed so that said helical surfaces are operatively unlockable from said locked positions during relative rotational movement of said barrel and cap members without uncoupling said coupling means.

4. An assembly, as set forth in claim 3, with

(a) said coupling means having rotatable wedge-type coupling surfaces coupling said members together in said coupled position,

(b) the unlocking force bearing the following ratio to the rotatable uncoupling force:

$$Q(f \cos A+\sin A) \cos A<Q1(f1 \cos A1+\sin A1) \cos A1$$

wherein $f1$ is the coefficient of friction of the wedge-type coupling surfaces, A1 is ½ the helix angle of the wedge-type coupling surfaces, Q1 are the forces acting on the sides of wedge-type coupling surfaces, f is the coefficient of friction of the helical surfaces, A is ½ the helix angle of the helical surfaces, and Q are the forces acting on the sides of the selected helical surfaces.

5. An assembly, as set forth in claim 3, with

(a) the unlocking force bearing the following ratio to said rotatable uncoupling force:

$$Q(f \cos A+\sin A) \cos A<F$$

wherein F is the rotatable uncoupling force, f is the coefficient of friction of the helical surfaces, A is ½ the helix angle of the helical surfaces, and Q are the forces acting on the sides of the helical surfaces.

6. An assembly comprising a drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position with the other of said members in said coupled position closing said uncoupled end on said one member,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a coupling means as described,

(f) coupling lock up at the coupling means providing a rotatable gripping force,

(g) said rotatable gripping force being greater than the rotatable gripping force by lock up at said helical surfaces.

7. A writing instrument, comprising

(a) a cap member,

(b) a barrel member connected to said cap member,

(c) coupling means for detachably connecting said members with the members movable between uncoupled and coupled positions, and

(d) drive mechanism operatively secured in at least one of said members,

(e) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(f) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced and a retracted position,

(g) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(h) said drive mechanism and coupling means being operable by relative rotational movement of said members so that relative rotational movement of said members:

(1) in a first direction, will move said members from said uncoupled to said coupled position,

(2) in the opposite of said first direction, will move said members from said coupled to said uncoupled position, and

(3) when in coupled position, movement in either direction will move said scribe element between scribe element advanced and retracted positions without uncoupling said members,

(i) the other of said members in said coupled position closing said uncoupled end on said one member.

8. A writing instrument, as set forth in claim 7, with

(a) said drive mechanism being constructed so that the surface of said bore for said scribe element in uncoupled position projects the minimum distance out of said one member.

9. A writing instrument, as set forth in claim 8, with

(a) said parts and said coupling means having threads of opposite hands.

10. An assembly comprising a drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position with the other of said members in said coupled position closing said uncoupled end on said one member,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a coupling means as described,

(f) said coupling means being frictionally snug enough during any attempted movement in the direction of relative rotation of said members in said coupled position for permitting at all times relative operative sliding movement between said helical surfaces in either advancing or retracting directions but with said coupling means being free enough to be uncoupled when desired.

11. An assembly, as set forth in claim **10**, with

(a) said coupling means including two cylindrical telescopically and rotatably connectable surfaces having a snug fit and carried one by each member.

12. An assembly, as set forth in claim **10**, with

(a) said parts including barrel cams having said helical surfaces.

13. An assembly, as set forth in claim **10**, with

(a) said parts having said helical surfaces formed by screw threads.

14. An assembly, as set forth in claim **10**, with

(a) said coupling means having a helical surface providing said coupling action,

(b) the lead on the helical surfaces on said drive mechanism parts being greater than the lead on the helical surface on said coupling means, whereby said scribe element can be advanced and retracted rapidly and said coupling means has the aforedescribed frictionally snug but free enough characteristics.

15. An assembly comprising a drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a coupling means as described,

(f) said coupling means being frictionally snug enough during any attempted movement in the direction of relative rotation of said members in said coupled position for permitting at all times relative operative sliding movement between said helical surfaces in either advancing or retracting directions but with said coupling means being free enough to be uncoupled when desired,

(g) said coupling means including two rotatably and connectable bayonet surfaces carried one by each member.

16. A writing instrument, comprising

(a) a cap member,

(b) a barrel member connected to said cap member,

(c) coupling means for detachably connecting said members with the members movable between uncoupled and coupled positions, and

(d) drive mechanism operatively secured in at least one of said members,

(e) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(f) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced and a retracted position,

(g) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(h) said driver part being operatively secured to said one member against relative axial and rotative movement,

(i) said drive mechanism including a coupler operatively secured to the other of said members by said coupling means against relative axial and rotative movement in said coupled position,

(j) said coupler and said driven part being connected by a keyed connection permitting axial relative movement in said advancing and retracting directions.

17. A writing instrument, as set forth in claim **16**, with

(a) a component being secured to said one member against relative axial and rotative movement,

(b) said coupler being rotatably connected to said component by a connection preventing substantial axial relative movement between said component and coupler,

(c) said coupler and said component having coacting relatively rotatable and telescoped surfaces forming said connection, one of said surfaces being a peripheral surface and the other of said surfaces being a bore surface.

18. A writing instrument, as set forth in claim **17**, with

(a) one of said surfaces having an annular groove therein,

(b) the other of said surfaces having an annular ring thereon,

(c) said ring and groove coacting together for preventing relative axial movement between said coupler and said driver part.

19. A writing instrument, as set forth in claim **18**, with

(a) said groove and ring each being triangular in cross section.

20. A writing instrument, as set forth in claim **18**, with

(a) one of said surfaces having at least one axially extending split for permitting telescopic assembly of said coupler and said component.

21. A writing instrument, as set forth in claim **17**, with

(a) one of said surfaces having an annular groove therein,

(b) the other of said surfaces having at least one hole extending radially therethrough in axial alignment with said groove,

(c) said one member having a bore,

(d) and a ball located in said hole between said annular groove and the bore in said one member.

22. A drive unit for a writing instrument including a cap member and a barrel member and a coupling means moveable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for driv-

ingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a cylindrical surface,

(f) one of said parts being fixed against axial movement relative to said cylindrical surface,

(g) said drive mechanism including a drag means carried by the other of said parts telescopically engaging and rotatable relative to said cylindrical surface by a frictional drag action during said advancing or retracting movement.

23. A drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a cylindrical surface,

(f) one of said parts being fixed against axial movement relative to said cylindrical surface,

(g) said drive mechanism including a drag means carried by the other of said parts telescopically engaging said cylindrical surface by a frictional drag action during said advancing or retracting movement,

(h) said drag means including a drag ring integral with said other part.

24. A drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) a cylindrical surface,

(f) one of said parts being fixed against axial movement relative to said cylindrical surface,

(g) said drive mechanism including a drag means carried by the other of said parts telescopically engaging said cylindrical surface by a frictional drag action during said advancing or retracting movement,

(h) said drag means including a drag ring telescopically connected to said other part and engaging said cylindrical surface by a frictional drag action during said advancing or retracting movement.

25. A drive unit for a writing instrument, as set forth in claim **24**, with

(a) said drag ring having an annular groove in one axial face thereof with said groove being generally triangular in cross section.

26. A drive unit for a writing instrument, as set forth in claim **25**, with

(a) said drag ring and other part having frictionally contacting bore and peripheral surfaces.

27. A drive unit for a writing instrument, as set forth in claim **24**, with

(a) said drag ring being connected to said other part by a sleeve-like carrier telescopically connected at opposite ends to said other part and to said drag ring.

28. A drive unit for a writing instrument, as set forth in claim **24**, with

(a) a sleeve telescopically connected to said other part,

(b) an axial stop carried by said other part,

(c) said sleeve and drag ring being axially movable relative to said other part,

(d) said drag ring being axially located between one end of said sleeve and said stop,

(e) the other end of said sleeve engageable with said one part in said advanced position,

(f) said drag ring being made of radially deformable material,

(g) whereby relative advancing movement of said parts to said writing or advanced position causes said sleeve to be pushed by said one part toward said stop for radially deforming said drag ring into a frictionally locked position against said cylindrical surface.

29. A drive unit for a writing instrument including a cap member and a barrel member and a coupling means movable between uncoupled and coupled positions for detachable connecting by a coupling movement the contiguous ends of said members, comprising

(a) drive mechanism operatively connected to one of said members,

(b) said drive mechanism including a bore for drivingly receiving a scribe element through the uncoupled end of said one member,

(c) said drive mechanism including a driver part responsive to relative rotational movement of said one member in said coupled position relative to the other of said members for moving said scribe element between an advanced position and a retracted position,

(d) said drive mechanism including with said driver part a driven part having cooperating coacting helical surfaces rotated by said barrel and cap members for causing said advancing or retracting movement of said driven part,

(e) said drive mechanism including a drag means comprising a helical compression spring axially pushing said helical surfaces on said parts axially together to provide a frictional drag action during said advancing or retracting movement.

30. A drive unit for a writing instrument, as set forth in claim **29**, with

(a) said helical surfaces being screw threads.

31. A drive unit for a writing instrument, as set forth in claim 29, with

(a) said helical surfaces being cam surfaces on coacting barrel cams.

References Cited by the Examiner

UNITED STATES PATENTS

954,415	4/1910	Boman	120—42.02
2,291,859	8/1942	Andrews	120—42.04 X
2,304,229	12/1942	Andrews	120—42.04 X
2,454,086	11/1948	Randolph	120—42.03
2,565,556	8/1951	Gruber	120—42.03
2,565,601	8/1951	Fischer	120—42.03

2,753,844	7/1956	Boss	120—18 X
3,106,908	10/1963	Gretz	120—18

FOREIGN PATENTS

8,198 of 1903	2/1904	Great Britain.
424,069	2/1935	Great Britain.
693,561	7/1953	Great Britain.
785,249	10/1957	Great Britain.

EUGENE R. CAPOZIO, *Primary Examiner.*

JEROME SCHNALL, *Examiner.*

E. HOROWITZ, H. F. ROSS, *Assistant Examiners.*