United States Patent

Kolb et al.

[15] **3,662,468**

[45] **May 16, 1972**

[54] PRECISION COMPASSES OR DIVIDERS

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[73] Assignee: **J. S. Staedtler,** Nurnberg, Germany

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[52] **U.S. Cl.** ..... **33/27 B**

[51] **Int. Cl.** **B43l 9/00**

[58] **Field of Search** ..... 33/27 B, 149 R, 149 B, 153 B, 33/154, 143 J, 164 R, 152 B, 149 H; 287/54.1, 20 P

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Primary Examiner—Leonard Forman
Assistant Examiner—Charles E. Phillips
Attorney—Kelman and Berman

[57] **ABSTRACT**

Compasses or dividers having legs connected by a rod which engages the legs with right-handed and left-handed threads respectively and carries a knurled, central adjusting wheel are equipped with a brake for impeding rotation of the rod. The threads on the latter have a pitch sufficient to permit the legs to be moved freely toward and away from each other for coarse adjustment and thereby to rotate the rod when released by the brake. When the latter is applied, the rod can be turned only by means of the adjusting wheel for a fine adjustment which cannot be disturbed by forces acting on the legs. Numerous brake mechanisms are disclosed.

18 Claims, 15 Drawing Figures

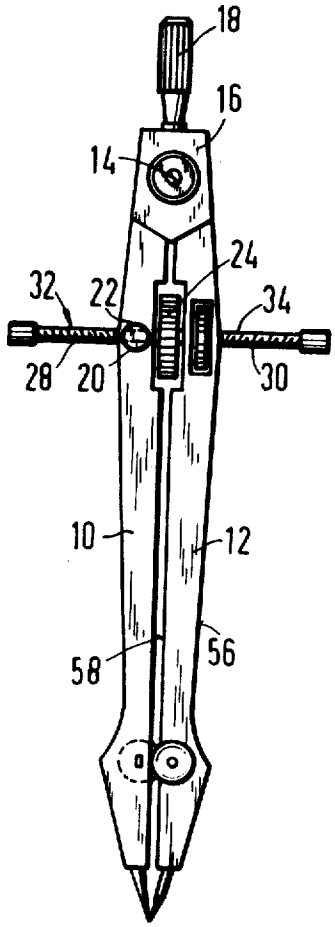


FIG. 1

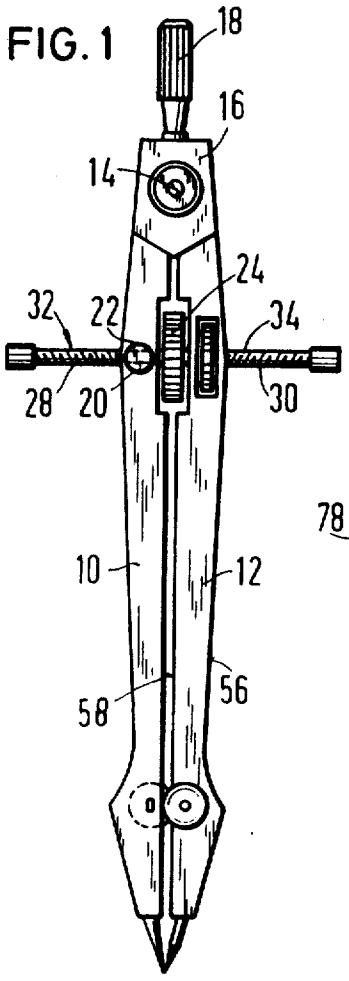


FIG. 2

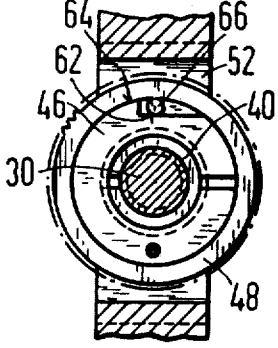


FIG. 3

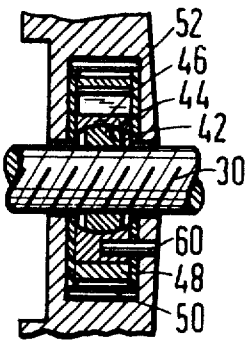


FIG. 4

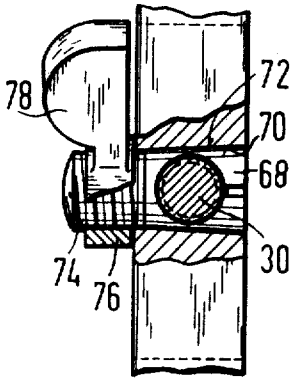


FIG. 5

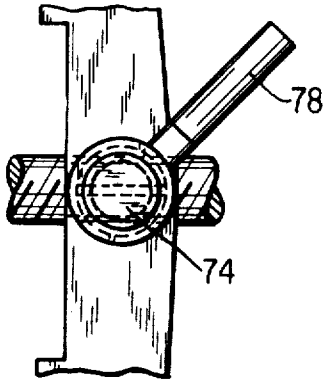


FIG. 6

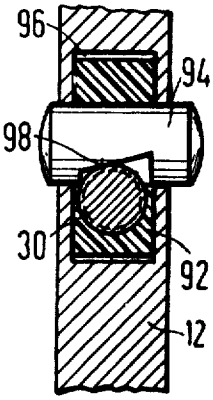


FIG. 7

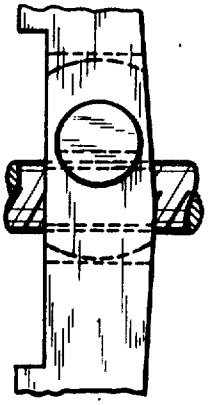


FIG. 8

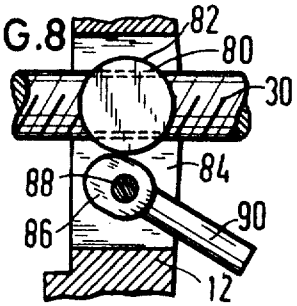


FIG.9

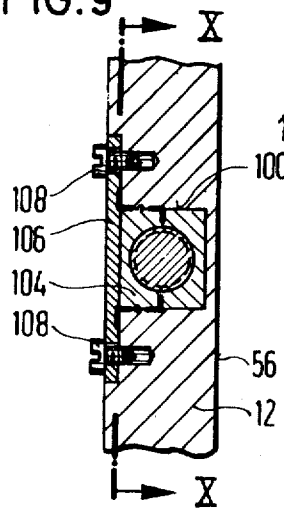


FIG.10

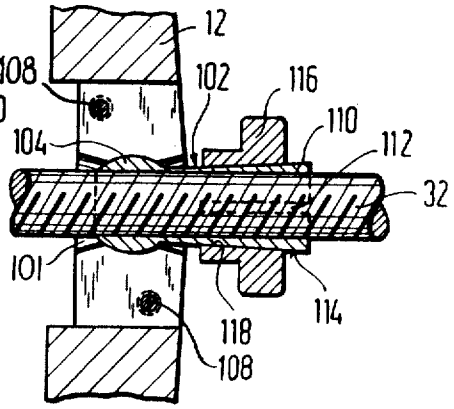


FIG.11

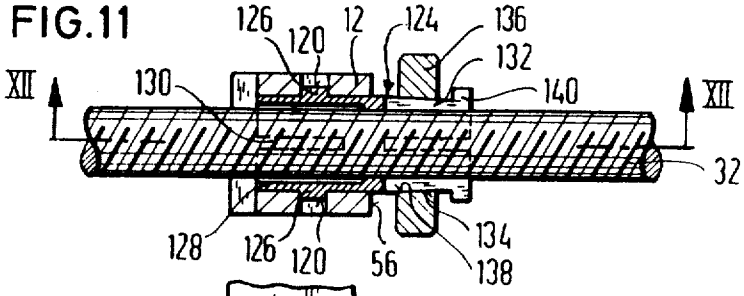


FIG.12

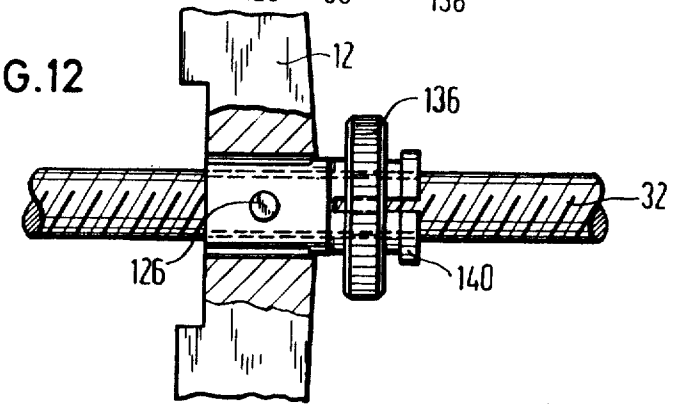


FIG. 13

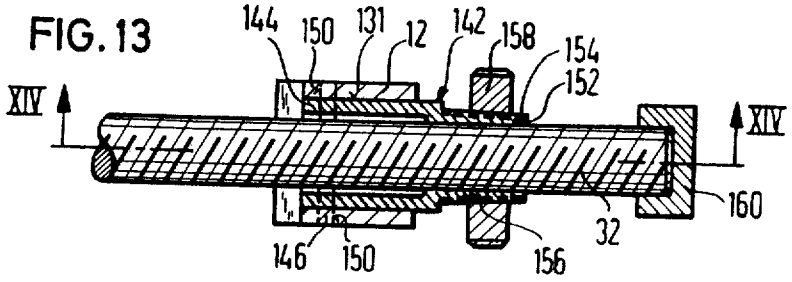


FIG. 14

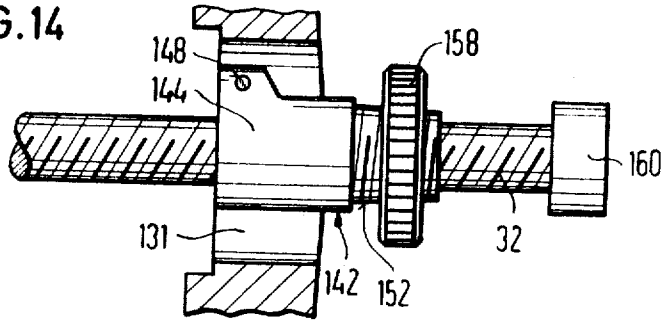
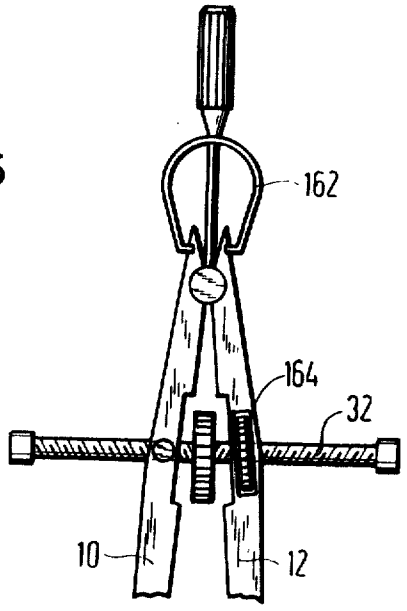


FIG. 15



PRECISION COMPASSES OR DIVIDERS

This invention relates to compasses or dividers, and particularly to an improvement in such drafting instruments in which the angular relationship of the two legs can be adjusted by means of a threaded rod which threadedly engages at least one of the legs and is rotatable in the other leg.

The pitch of the threads on the adjusting rods is small enough in conventional instruments of the general type referred to above that the threads are self-locking. Forces exerted in opposite directions on the portions of the legs directly engaged by the adjusting rod cannot angularly displace the legs about the connecting pivot. Adjustment of such compasses or dividers requires the turning of a knurled wheel or the like fixed on the adjusting rod, and is inconvenient when the angle of the legs is to be changed much.

It has now been found that a drafting instrument of the described type may be quickly and conveniently adjusted over relatively large angles if the pitch of the threads on the adjusting rod is sufficiently great to permit the legs to be moved by directly applied forces and thus to cause rotation of the adjusting rod when opposite forces are applied in the direction of the rod axis to those leg portions which are directly engaged by respective axial portions of the adjusting rod, and that the instrument may then be set precisely and securely by means of an adjusting wheel or the like fixedly mounted on the rod and accessible for turning the rod after application of a brake which impedes rotation of the rod to prevent its being turned by the afore-mentioned opposite axial forces.

In the preferred embodiments of the invention, an internally threaded member is mounted on one of the instrument legs and threadedly receives an axial portion of the adjusting rod. The brake is operated by deforming the internally threaded member so as to tighten the same on the engaged axial portion of the rod.

Other features and many of the attendant advantages of this invention will readily be appreciated as the same becomes better understood by reference to the following detailed description of preferred embodiments when considered in connection with the appended drawing in which:

FIG. 1 shows compasses of the invention in front elevation;

FIG. 2 shows the instrument of FIG. 1 in enlarged, fragmentary, side-elevational section;

FIG. 3 illustrates the device of FIG. 2 in front elevational section on its median plane;

FIGS. 4 and 5 show a modification of the device of FIGS. 2 and 3 in respective corresponding views;

FIG. 6 illustrates another modification of the device of FIG. 2 in a corresponding view;

FIG. 7 is a front elevational view of the device of FIG. 6;

FIG. 8 illustrates a further modification of the device of FIG. 3 in a corresponding view;

FIGS. 9 and 10 show yet another modification of the device of FIGS. 1. and 2 in corresponding respective views;

FIG. 11 illustrates an additional modification of the device of FIGS. 1 and 2 in sectional plan view;

FIG. 12 shows the device of FIG. 11 in section on the line XII—XII;

FIG. 13 illustrates a variant of the device of FIG. 11 in a corresponding view;

FIG. 14 shows the device of FIG. 13 in front elevational section on the line XIV—XIV; and

FIG. 15 shows spring bow dividers of the invention in fragmentary front elevation.

Referring now to the drawing in detail, and initially to FIG. 1, there is seen a pair of compasses having two legs 10, 12 connected by a pivot pin 14 in a head 16 on which a short handle 18 is fixedly mounted. A transverse bore 20 in the leg 10 spacedly adjacent the head 16 rotatably receives a rod-shaped, plastic insert 22.

A knurled, central adjusting wheel 24 is fixedly mounted on a rod 32 between the two legs 10, 12. The rod 32 passes through openings in the legs 10, 12. Its outwardly projecting portions 28, 30 carry relatively steeply pitched threads 34 which are right-handed on the rod portion 28 and left-handed on the rod portion 30. The portion 28 of the rod 32 engages mating internal threads in the plastic insert 22, and the portion 30 is threadedly mounted on the leg 12, as will presently be described in more detail.

The pitch of the threads 34 is sufficiently great to permit the legs 10, 12 to be moved normally relative to each other on the pin 14, whereby the rod 32 and the wheel 24 are turned for coarse adjustment of the compasses. For fine adjustment, the wheel 24 is turned, as is conventional in itself.

As is better seen in FIGS. 2 and 3, the rod portion 30 is threadedly received in a split nut 40 having a spherically convex outer face 42 conformingly engaging a spherically concave face 44 of a split ring 46. The latter is coaxially enveloped by an adjusting ring 48 whose outer face is formed with knurls 50. The coaxially assembled nut 40, split ring 46, and knurled ring 48 are set in a slot 52 of the leg 12 which is parallel to the side faces 56, 58, of the leg.

A pin 60 secures the split ring 46 to the leg 12 and prevents rotation of the ring about the axis of the rod 32. A recessed outer face portion 62 of the split ring 46 and the inner face 64 of the knurled ring 48 bound a circumferentially tapering receptacle for a clamping roller 66. When the ring 48 is turned clockwise, as viewed in FIG. 2, the roller 66 is wedged between the faces 62, 64, compresses the split ring 46, and thereby locks the split nut 40 on the threads of the rod portion 30 with a force sufficient to prevent the rod 32 from being turned by forces directly applied to the legs 10, 12. A relative position of the legs 10, 12 which was coarsely set by moving the legs 10, 12 relative to each other can then be adjusted precisely by turning the central wheel 24 and is maintained until the knurled ring 48 is turned counterclockwise.

In the modified compasses partly shown in FIGS. 4 and 5, and otherwise identical with the apparatus described with reference to FIGS. 1 to 3, a split braking nut 68 threadedly engaged by the portion 30 of the rod 32 has a frustoconical face 70 mating the wall of a frustoconical bore 72 in the leg 12, and is axially split from the larger base of the face 70 to the internal threads thereof. An externally threaded portion 74 of the nut 68 coaxial with the face 70 projects from the leg 12 and carries a nut 76 in abutting engagement with the front face of the leg. A radial arm 78 permits the nut to be turned manually, and the nut 68 to be drawn thereby toward the narrower end of the bore 72 into the illustrated position, whereby the nut is clamped more tightly on the rod portion 30 and prevents the same from being turned accidentally by forces exerted on the legs 10, 12 without interfering with the fine adjustment of the compasses by the adjusting ring 48 which overrides the braking effect of the nut 40.

In the further embodiment of the invention partly illustrated in FIG. 8, the threaded portion 30 of the rod 32 passes through an internally threaded bar 80 of resilient plastic whose ends are retained in a bore 82 of the leg 12 transverse to the axis of the rod 30. The rod portion 30 and the central part of the bar 80 are exposed in a slot 84 of the leg 12 in which an eccentric braking cam 86 is mounted on a pivot pin 88. A radial arm 90 is fixedly fastened to the cam 86 and extends outwardly from the slot 84 beyond the outer side face of the leg 12. The angular position of the legs 10, 12 may thus be maintained by pivoting the arm 90 on the pin 88 in a clockwise direction, as viewed in FIG. 8, without interfering with fine adjustment by means of the central wheel 24.

Yet another partial modification of the compasses shown in FIG. 1 is illustrated in FIGS. 6 and 7. The rod portion 30 is threadedly received in a somewhat resilient plastic clamping nut 92. The nut 92 is rotatably retained in a slot 96 of the leg 12 by a pin 94 whose ends project from opposite longitudinal faces of the leg. A recess cut into the cylindrical outer face of the pin 94 has a cam face 98 obliquely inclined relative to the pin axis which is offset 90° from the axis of the rod portion 30, the rod portion being partly received in the recess of the pin, and the longitudinal movement of the pin being limited by abutment of the rod portion against the walls of the recess.

In the braking position illustrated in FIG. 6, the pin 94 clamps the portion 30 against the yielding nut 92 and thereby prevents rod from turning except by means of the wheel 24. When it is desired to release the legs 10, 12, the pin is pushed manually toward the left.

In the additional embodiment seen in FIGS. 9 and 10, the leg 12 is formed with a cylindrical socket or receptacle 100 whose axis is perpendicular to that of the rod portion 30 and which communicates with grooves 101 in the leg 12 which are radial relative to the socket axis. The rod portion 30 passes through these grooves and diametrically through the socket 100 which has one blind axial end and whose other axial end, together with the radial grooves, is normally closed by a cover plate 106 fastened by two screws 108.

An internally threaded sleeve 102 has a cylindrical enlargement or head 104 which is conformingly and pivotally received in the socket 100 and a portion 110 whose outer face 114 flares conically at a small apex angle outward of the receptacle 100 through one of the afore-mentioned radial grooves. The sleeve portion 102 has two opposite axial slots 112 extending to the free end of the sleeve remote from the head 104. The rod 32 is threadedly received in the sleeve 102 and may be clamped in the sleeve and thereby prevented from rotating about its axis under forces directly applied to the legs 10, 12 by a ring 116 whose conically tapering bore 118 matches the sleeve face 114. The ring circumferentially narrows the slots 112 when moving from the left to the right, as viewed in FIG. 10. When the rod 32 is removed from the sleeve 102, the slotted end of the latter may be compressed sufficiently for slipping the ring 116 axially into the illustrated position or off the sleeve 102. The common apex angle of the sleeve face 114 and of the bore 118 is small enough that the ring 116 is secured by friction in the axial braking position.

In the arrangement illustrated in FIGS. 11 and 12, the rod 32 passes through an oversized transverse bore of the leg 12. An internally threaded sleeve 124 on the rod 32 has a portion 128 in the oversized bore of the leg 12 and is pivotally secured therein by short trunnions 126 extending into a bore 120 which connects the front and rear faces of the leg 12. Axially open slots 130 in the sleeve portion 128 permit the resilient sleeve 124 to be compressed in the absence of the rod 32 for insertion into the leg 12 until the trunnions 126 drop into the bore 120.

The portion 132 of the sleeve 124 which projects from the leg 12 is axially slotted. The slightly conical outer face 134 of the sleeve portion 132 tapers away from the portion 128 and terminates in an outer radial flange 140 which normally retains a clamping ring 136. The bore 138 of the ring 136 conforms to the outer sleeve face 134. The ring 136 impedes rotation of the rod 32 when in the illustrated position, and releases the rod when shifted toward the right, as viewed in FIGS. 11 and 12. It may be removed from the sleeve 124 by first withdrawing the rod 32, and thereafter compressing the sleeve portion 132 until the ring 136 can be slipped over the flange 140.

The leg 12 seen in FIGS. 13 and 14 has a transverse slot 131 through which the rod 32 passes in threaded engagement with an internally threaded sleeve 142. The portion 144 of the sleeve which is received in the slot 131 is rectangular in cross section and loosely envelops the rod 32. It is attached to the leg 12 by a pivot pin 146 laterally and angularly off-set from the rod axis. The pin passes through openings 148 in the sleeve portion 144 and enters openings 150 in the leg 12. The braking portion 152 of the sleeve 142 outside the slot 131 has a conically tapering, threaded, outer face 154 and is slotted. It is engaged by a matingly threaded internal face 156 of a clamping ring 158 which is secured against loss by a cap 160 on the rod 32.

The divider partly shown in FIG. 15 has two legs 10, 12 connected by a bow spring 162 which tends to separate the needle points of the legs 10, 12, not visible in FIG. 15. The pitch of the threads on the rod 32 which connects the legs 10, 12 as described above, is steep, and friction in the engaged threads is too small to prevent the angle between the legs to be enlarged under the pressure of the spring 162. A knurled ring 164 coaxially mounted on the rod 32 in a slot of the leg 12, and substantially identical with the ring 48 in FIGS. 1 to 3 permits the legs 10, 12 to be held in any desired angular position against the urging of the bow spring 162 in a manner described above with reference to FIGS. 1 to 3, the other elements of the clamping mechanism being concealed in FIG. 15 as they are in FIG. 1.

The threads 34 on the rod 32 in all illustrated embodiments of the invention have single right-hand and left-hand threads. If so desired, multiple threads may be chosen where a great pitch is desired.

The several embodiments of the invention illustrated and described permit quick, coarse, angular adjustment of the legs 10, 12 by either gripping each leg in one hand and moving the legs relative to each other (FIGS. 1 — 14) or by compressing or releasing the spring 162 (FIG. 15) by means of one hand applied to both legs 10, 12. The central wheel of all embodiments permits fine adjustment while the several braking mechanisms secure the adjusted position against accidental change by forces directly applied to the legs. It will be appreciated that all modifications of the compasses shown in FIGS. 4 to 14 are equally applicable to the spring bow dividers seen in FIG. 15. For the purpose of this invention, compasses and dividers are fully equivalent or interchangeable.

The rod 32 is threadedly and pivotally mounted in each of the legs 10, 12 in all illustrated embodiments, and such an arrangement is preferred. Many advantages of the invention can be achieved however, if the rod is rotatable with respect to both legs, but threadedly secured to only one leg. It may be axially fixed on the other leg as by a head similar to the illustrated head 114.

What is claimed is:

1. Compasses or dividers comprising:
   a. two leg members;
   b. pivot means securing respective terminal portions of said leg members to each other for angular movement;
   c. a rod member having an axis,
      1. an axial portion of said rod member being rotatably connected to a portion of one of said leg members,
      2. a portion of the other leg member carrying threads,
      3. another axial portion of said rod member being threaded and matingly engaging said threads on said other leg member,
      4. said portions of said leg members being spaced from said pivot means,
      5. the pitch of said threads and of the matingly engaged threaded portion of said rod member being sufficiently great to cause rotation of said rod member when opposite forces are applied to said portions of the leg members in the direction of said axis;
   d. braking means for increasing the friction between said other axial portion and said threads and for thereby preventing said rotation of the rod member by the applied opposite forces; and
   e. adjusting means on said rod member and accessible for manually turning said rod member and overriding said braking means.

2. Compasses or dividers as set forth in claim 1, wherein said braking means include an internally threaded member mounted on said other leg member, said other axial portion of said rod member being threadedly received in said internally threaded member, and operating means for deforming said internally threaded member so as to increase the friction between the same and said other axial portion.

3. Compasses or dividers as set forth in claim 2, wherein said internally threaded member is formed with a slit extending in the direction of said axis, said operating means being effective in circumferentially narrowing said slit.

4. Compasses or dividers as set forth in claim 2, wherein said internally threaded member essentially consists of resiliently yieldable material.

5. Compasses or dividers as set forth in claim 2, wherein said internally threaded member has a spherically convex outer face, and said operating means include a split ring having a spherically concave inner face engaging said outer face, a manually rotatable ring member enveloping said split ring, and tightening means responsive to rotation of said ring member for tightening said split ring on said internally threaded member.

6. Compasses or dividers as set forth in claim 5, wherein said split ring and said ring member have opposite faces approaching each other in the direction of rotation of said ring member, and said tightening means includes a clamping member movably interposed between said faces.

7. Compasses or dividers as set forth in claim 2, wherein said internally threaded member has an outer face tapering in a direction transverse to said axis, said other leg member being formed with a bore and engaging said outer face in said bore, said operating means including means for moving said threaded member in said transverse direction.

8. Compasses or dividers as set forth in claim 7, wherein said internally threaded member partly projects from said bore through an outer face of said other leg member, the projecting part carrying external threads, and said operating means including a nut member threadedly mounted on said projecting part for abutting engagement with said outer face of the other leg member.

9. Compasses or dividers as set forth in claim 2, wherein said operating means include a cam member mounted on said other leg member, and actuating means for moving said cam member relative to said internally threaded member.

10. Compasses or dividers as set forth in claim 9, wherein said cam member is pivotally mounted on said other leg member.

11. Compasses or dividers as set forth in claim 9, wherein said cam member is mounted for substantially rectilinear movement transversely of said axis.

12. Compasses or dividers as set forth in claim 11, wherein said internally threaded member is secured to said other leg member by said cam member for rotation about an axis extending in the direction of movement of said cam member, movement of said cam member in said direction of movement being limited by abutting engagement thereof with said rod member.

13. Compasses or dividers as set forth in claim 2, wherein said internally threaded member is partly received in said other leg member and partly projects from the leg member, the projecting part having an outer face tapering in an axial direction, and being formed with an axially extending slot, said operating means including a ring member axially movable on said projecting part in engagement with said tapering outer face.

14. Compasses or dividers as set forth in claim 13, said outer face tapering conically at an apex angle small enough to secure the axial position of said ring member by friction.

15. Compasses or dividers as set forth in claim 2, wherein said other leg member is formed with a socket, said internally threaded member having an enlarged head portion received in said socket for angular movement about an axis transverse to the axis of said rod member.

16. Compasses ordividers as set forth in claim 2, further comprising two trunnion means on said internally threaded member rotatably engaging respective recesses in said other leg member for angular displacement of said rod member relative to said other leg member about an axis transverse to the axis of said rod member.

17. Compasses or dividers as set forth in claim 16, wherein said internally threaded member is resilient and formed with a slot, said slot being circumferentially interposed between said trunnion means and of a width sufficient for disengagement of said trunnion means from said recesses when said internally threaded member is compressed in the direction of said transverse axis.

18. Compasses or dividers as set forth in claim 2, wherein said braking means include a braking member movable on said other leg member, said operating means including means for moving said braking member toward and away from a position of deforming engagement with said internally threaded member.

* * * * *