Dec. 12, 1944. J. NASH 2,364,805

DRAFTING INSTRUMENT AND THE LIKE

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Fig. 1.

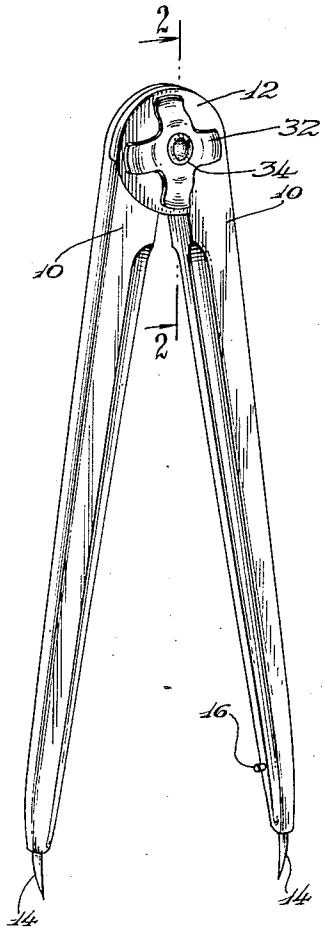
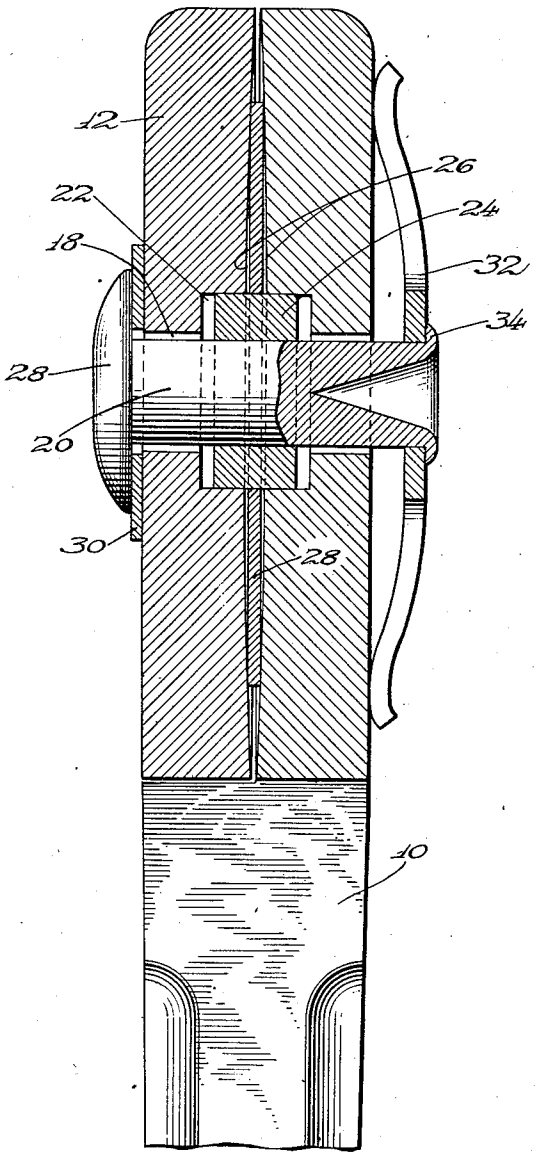


Fig. 2.



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DRAFTING INSTRUMENT AND THE LIKE

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9 Claims. (Cl. 33—153)

The present invention relates to drafting or navigating instruments and the like and is more particularly concerned with the provision of improved pivoted leg type instruments commonly known as dividers, or compasses. The invention also is applicable to tools of the type known as calipers and to other similar articles. The present invention is illustrated and described as embodied in dividers, but it will be appreciated that the invention is not limited to this specific use.

In the past, dividers, with the exception of small bow dividers, have consisted essentially of a pair of metal legs pivoted together at their upper ends and provided at their lower ends with points. One of the principal difficulties in providing a satisfactory instrument of this type is to pivot the arms in such a manner that they move smoothly, but under sufficient restraint so that any particular setting of the legs will not easily be disturbed. Additionally, an instrument of this type should not be springy, that is, it should be relatively easy to set the points to any particular dimension merely by squeezing the arms together, or by urging them apart, and once the points have been properly located, they should neither spring inwardly nor outwardly when the setting pressure is removed.

One of the objects of the present invention is to provide a navigating, drafting, or like instrument of the above type comprised principally of a plastic material. One plastic material well suited for this purpose is that formed as a phenol formaldehyde condensation product.

An additional object is to provide an improved instrument of the type described, which is well suited to be manufactured principally from plastic materials.

Yet another object of the present invention is to provide a novel navigating, drafting, or similar instrument which can be economically manufactured at extremely low cost without sacrificing accuracy and other desirable characteristics.

Still another object of the present invention is to provide a novel instrument of the pivoted leg type having a minimum quantity of metal therein.

Still another object of the present invention is to provide a novel pivoted leg type instrument, which is much lighter than comparable instruments now commonly in use.

Other objects and advantages will become apparent from the following description of a preferred embodiment of my invention, illustrated in the accompanying drawing, in which:

Fig. 1 is a perspective view of a pair of dividers embodying the present invention, and;

Fig. 2 is a transverse sectional view on a much enlarged scale of the pivot joint of the dividers shown in Fig. 1.

The principal structural elements of the dividers shown in Fig. 1 are a pair of legs **10**. These legs may be of any desired length and are generally tapered from top to bottom and should be of sufficient section to insure their stiffness in use. At its upper end, each of the legs is formed to provide a disc shaped portion **12** having a thickness approximately one-half that of the adjacent portion of the leg. This disc shaped portion is offset to one side so that its outer face is in the plane of the outer face of the adjoining portion of the leg, while its inner face is approximately midway between the two leg faces. The two legs may be identical, and their lower ends are drilled to receive points **14** press-fitted or cemented in place. Slightly above the free ends of the divider legs one of the legs is provided on its inner side with a small pin **16**, which extends into a complementary opening, not shown in the other divider leg when the dividers are closed, so as to prevent sidewise spreading of the legs when the dividers are laid aside.

Each of the divider legs just described, with the exception of the points **14** and the pin **16**, is preferably molded in a single piece from plastic material. Inasmuch as the two legs are identical, both of the legs for a pair of dividers can be made in a single mold. Although it is preferred that the legs be molded, they may, of course, be fabricated by other methods and of other materials if desired.

The disc shaped portion **12** of each of the legs **10** is drilled at its center to provide a hole **18** through which a hinge pin **20** is passed to join together the two leg elements. As will appear presently, the hole **18** does not serve to locate the legs relative to each other and, therefore, the pin **20** can fit comparatively loosely in the hole **18**. This loose fit is best seen in Fig. 2.

The inner faces of the disc shaped portions **12**, that is, the faces, which will be in contiguous relationship when the dividers are assembled, are each counter-bored to provide a cylindrical recess **22** substantially coaxial with the hole **18**. When the dividers are assembled, a small phosphor bronze bushing **24**, having a comparatively close fit in the counter-bored portions **22**, is located with its ends in these counterbores and serves to prevent linear movement of the legs

relative to each other. The only dimensions in this portion of the assembly which need be held to close limits are the diameter of the counterbored portion 22, and the diameter of the cylindrical bushing 24.

The bushing should be of sufficient length so that it will have a portion of its length in both of the divider legs. It should not be so long, however, that it will strike the inner ends of the counterbores 22, so as to prevent the legs from being drawn closely together. The opening through the center of the bushing 24 through which the pin 20 passes need not closely fit the pin, since slight linear movement of the pin 20 from side to side relative to the bushing 24 will have no detrimental effect upon the accuracy of the instrument.

The inner faces of the disc shaped portions 12 should be comparatively smooth and should be slightly concave as indicated at 26. Although the amount of concavity is not critical, in the instrument shown in which the discs at the upper ends of the legs are approximately one inch in diameter, the concavity is such that the central portion of the surface is approximately .001 of an inch below the outer edge.

In assembling the device, the bushing 24 is surrounded by a thin phosphor bronze washer 28, approximately three-quarters of an inch in diameter and .01 of an inch thick in the instrument shown. This washer is flat, and because of the concavity of the faces of the legs, it touches these faces only at its periphery. There is thus provided a line contact around the edge of the washer where the washer touches each of the two legs.

This arrangement, I have found, provides an extremely smooth pivoting action, with proper restraint, and in addition makes the manufacture of the instrument relatively inexpensive, inasmuch as the washer 28 need not be held to close limits, since whether it touches the faces at a point three-eighths of an inch from the center of the implement or some point slightly further out or closer to the center is of little consequence.

The pivot pin 20 is of the rivet type and is provided at one end with a head 28, which bears with its inner face against a small thin copper washer 30, while its opposite end is hollow and extends through a central opening in a four legged leaf spring 32. To complete the assembly, the spring 32 is compressed slightly, and the hollow end of the pin 20 is rolled over with a rivet set to provide a shoulder 34, which prevents separation of the elements.

The legs of the leaf spring 32 bear against the external face of the disc shaped portion 12 of one of the divider legs, and thus the spring draws the two legs toward each other with their inner faces bearing against the edge of the washer 28. As the legs are moved, the leaf spring 32 will offer more resistance to movement over the face of the leg it bears against than will the head 28 of the pin 20. Thus, movement of the legs will be accompanied by rotation of the head 28 relative to its adjoining leg. Since the thin washer 30 is quite flexible, the wear will be well distributed over the surface of the plastic material.

Inasmuch as the pressure of the two concave faces against the washer 28 is concentrated at first at the extreme edge of the washer, this localization of the pressure quickly causes the plastic material or phosphor bronze washer to wear sufficiently to provide a good full line contact extending completely around the washer 28. Not much additional wear will take place, however, even after extended use, inasmuch as increased wear increases the width of the line contact, thus reducing the bearing pressure per unit area.

An inspection of the accompanying drawing together with the above description will show that in order to obtain extreme accuracy of adjustment together with the proper freedom of motion without the danger of linear movement of the legs relative to each other, it is necessary only that the external surface of the bushing 24 be comparatively closely fitted to the surface of the counterbored recess 22, and that the washer 28 be of comparatively uniform thickness. Ordinary sheet stock, however, has sufficient uniformity for this purpose. The concave surfaces 26 at the upper portions of the legs should also be held to comparatively close limits, but I have found that no difficulty is experienced in molding these legs with the concave surface formed during the molding process, any slight irregularities in the surface being quickly smoothed down by movement of the legs after assembly in the manner previously described.

I have found that an instrument constructed according to the present invention weighs about half as much as a comparable metal instrument manufactured in the conventional manner, and further, plastic materials of the type mentioned are extremely resistant to corrosion, and thus are not injured by dampness nor by perspiration. The instrument is, therefore, particularly well suited to use in navigation. It will be seen further that as the instrument wears, this wear will be taken up automatically by the spring 32, thus insuring proper functioning of the instrument over a period of many years.

While I have shown and described a particular embodiment of my invention, it will be apparent to those skilled in the art that numerous modifications and variations may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of the invention all such modifications and variations by which substantially the results thereof may be obtained by substantially the same or equivalent means.

I claim:

1. A drafting instrument or the like comprising a pair of legs having similar circular disc-like contiguous faces formed at their upper ends, said faces being slightly concave, a hinge pin extending through and joining said legs in a position substantially centrally of said faces, a thin flat washer surrounding said pin and located between said faces and bearing against both of said faces at its periphery, said washer being spaced from said faces at points other than its periphery by reason of the concave nature of said faces, resilient means cooperating with said hinge pin tending to urge said faces toward each other, and a cylindrical aligning member surrounding said pin near its midpoint and having its outer cylindrical surface extending into complementary recesses counterbored in said faces.

2. A drafting instrument or the like comprising a pair of legs having similar circular disc-like contiguous faces formed at their upper ends, a hinge pin extending through and joining said legs in a position substantially centrally of said faces, a thin flat washer surrounding said pin and located between said faces and bearing against both of said faces at its periphery, said faces having contours such that said washer is

spaced from said faces at points other than its periphery, resilient means cooperating with said hinge pin tending to urge said faces toward each other, and a cylindrical aligning member surrounding said pin near its midpoint and having its outer cylindrical surface extending into complementary recesses counter-bored in said faces.

3. A drafting instrument or the like comprising a pair of legs having similar circular disc-like contiguous faces formed at their upper ends, a centrally apertured cylindrical aligning member extending into complementary counterbored openings located substantially centrally of said faces, a hinge pin extending through said aligning member and through said legs in a position substantially centrally of said faces and joining said parts, a washer surrounding said aligning member and located between said faces and bearing against both of said faces at its periphery, said washer being spaced from said faces at points other than its periphery, and resilient means cooperating with said hinge pin tending to urge said faces toward each other.

4. A drafting instrument, or the like, comprising a pair of legs having similar circular disc-like contiguous faces formed at their upper ends, said faces being slightly concave, a cylindrical aligning member extending into complementary counter-bored openings located substantially centrally of said faces, a thin flat washer surrounding said aligning member located between said faces and bearing against both of said faces at its periphery, said washer being spaced from said faces at points other than its periphery by reason of the concave nature of said faces, and resilient means tending to urge said faces toward each other.

5. A drafting instrument or the like comprising a pair of legs having similar circular disc-like contiguous faces formed at their upper ends, said faces being slightly concave, a hinge pin extending through and joining said legs in a position substantially centrally of said faces, a thin flat washer surrounding said pin and located between said faces and bearing against both of said faces at its periphery, said washer being spaced from said faces at points other than its periphery by reason of the concave nature of said faces, and resilient means cooperating with said hinge pin tending to urge said faces toward each other.

6. A drafting instrument or the like comprising a pair of legs having similar circular disc-like contiguous faces formed at their upper ends, a hinge pin extending through and joining said legs in a position substantially centrally of said faces, a thin flat washer surrounding said pin and located between said faces and bearing against both of said faces at its periphery, said faces having contours such that said washer is spaced from said faces at points other than its periphery, and resilient means cooperating with said hinge pin tending to urge said faces toward each other.

7. A drafting instrument or the like comprising a pair of relatively angularly movable elements pivoted together, a pivot pin passing through said elements at the pivoting axis, resilient means biasing said relatively movable elements toward each other, the contiguous faces of said relatively movable elements being slightly concave, and a thin flat washer located between said faces substantially coaxial with said pivot pin.

8. A drafting device comprising two relatively pivotal parts, each of said parts having a hole formed at the axis of movement for the reception of a hinge pin and having enlarged counterbores at their contiguous faces, said counterbores being coaxial with said holes, an aligning bearing member positioned within said counterbores and engaging the cylindrical walls thereof, said bearing member being of less length than the overall length of said counterbores and having a hole extending axially therethrough, a hinge pin extending through the holes in said parts and said bearing member, and resilient means secured by said hinge pin to apply pressure to urge said parts together and thereby to impose a frictional force resisting relative rotation of said parts.

9. A drafting device comprising two relatively pivotal parts, each of said parts having a hole formed at the axis of movement for the reception of a hinge pin and having enlarged counterbores in their opposed faces, said counterbores being coaxial with said holes, a centrally apertured aligning bearing member engaging the walls of said counterbores in both of said parts, a hinge pin extending through the holes in said parts and through the aperture in said bearing member, and resilient means secured by said hinge pin to apply pressure to urge said parts together and thereby to impose a frictional force resisting relative rotation of said parts.

JAMES NASH.