

[54] PORTABLE INSTRUMENT

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[51] Int. Cl. B65d 25/28

[58] **Field of Search**..... 220/96, 95; 16/110 R;
248/226, 471, 470, 126, 12

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Primary Examiner—William I. Price

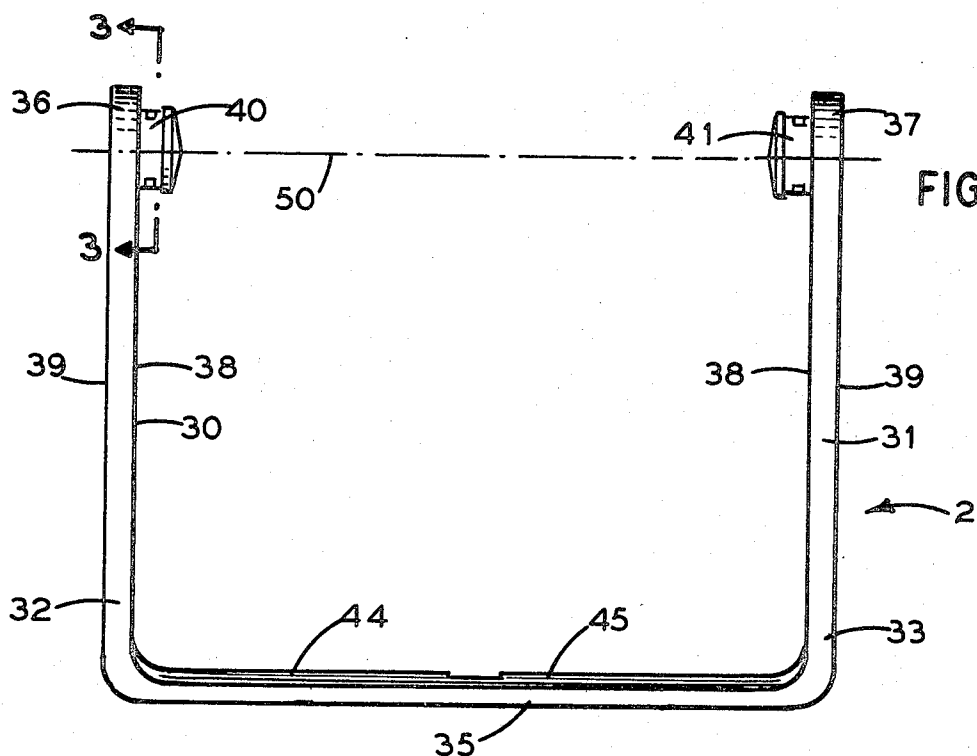
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[57] ABSTRACT

In accordance with one embodiment of the invention, a portable instrument is provided having a housing and a handle coupled thereto for carrying the instrument and supporting the housing in a selected position when the instrument is laid on a supporting surface. The handle has two arms joined by a handle bar at one end thereof and each arm has a deformable journal projecting inwardly adjacent its other end. These journals mount arcuate external projections at their periphery and are rotatively received in two concentric openings in housing side walls defining each opening. Each wall comprises camming lobes separated by arcuate recesses in which the projections of the journals are accommodated to lock the handles in a firm housing-supporting position. When the handle is rotated with respect to the housing, the projections are pressed inwardly by the camming lobes and snap outwardly again when these projections come opposite to a recess to effect locking of the handle.

13 Claims, 6 Drawing Figures



SHEET 1 OF 2

FIG. 1

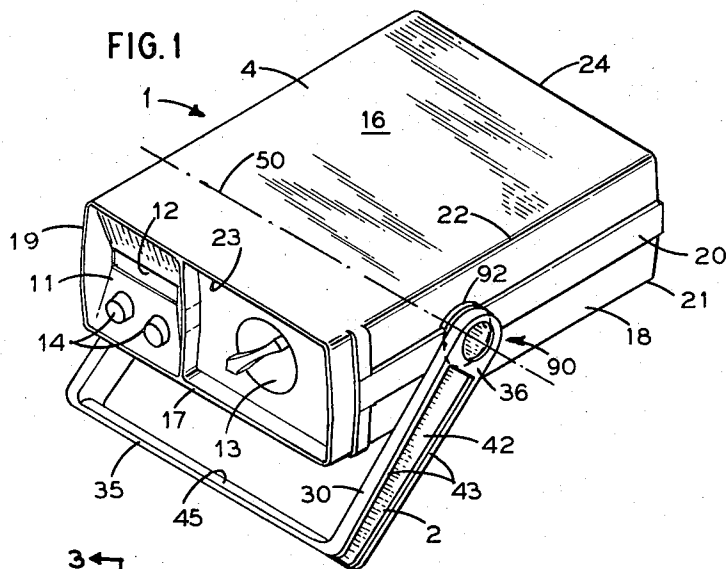


FIG. 2

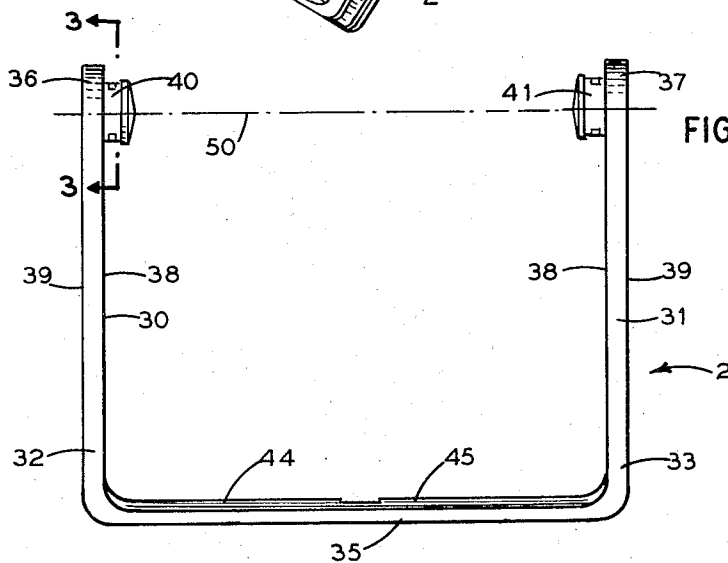


FIG. 3

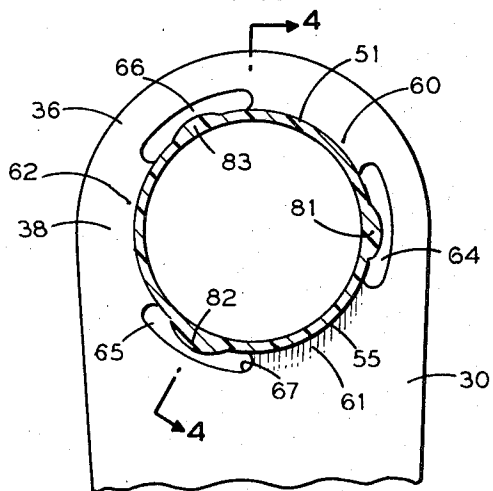


FIG. 4

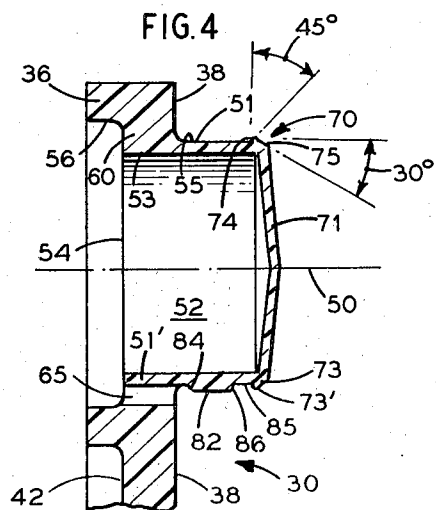


FIG. 5

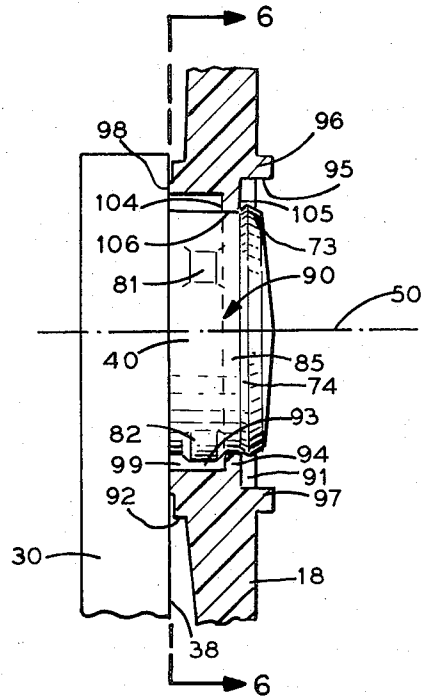
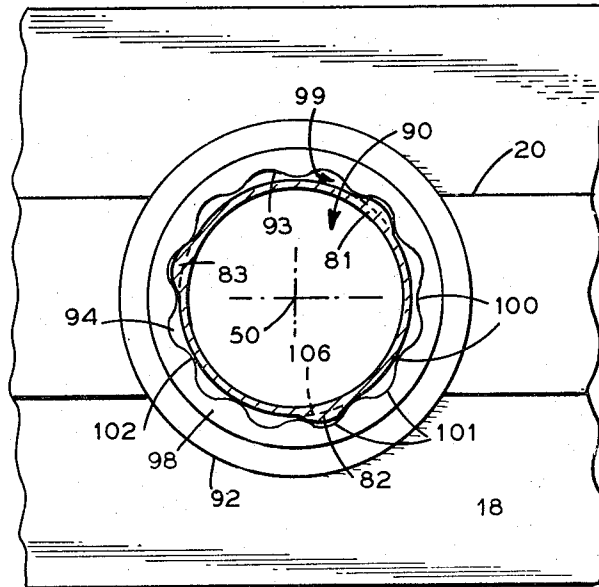


FIG. 6



PORTABLE INSTRUMENT

BACKGROUND OF THE INVENTION

The invention relates to bails for portable instruments and more particularly to handles which are coupled to a housing to carry and support the instrument on a bench or other surface in at least one selected position.

Portable instruments such as electrical meters are known to have a housing and a handle coupled thereto for providing both a means for carrying the instrument and a means for mounting the instrument in one of several different positions on a surface. Typically, a handle for such instrument has two parallel arms connected by a transverse handle bar. Each arm has its end opposite to the bar rotatably coupled to one side of the housing for rotation about a common axis. In addition to permitting holding the instrument for carrying it, the handle can be used as a leg for the instrument when it is laid down on a horizontal supporting surface such as a table. By locking the handle in a proper angular position with respect to the housing the front part of the instrument can be inclined such that the operator may conveniently observe the meter display, manipulate the control knobs and make electrical connections to the instrument.

Typically, the handle is constituted by one or two metallic U-shaped parts both joined at the free ends thereof to each side of the housing by a bolt member having its head shaped as a knob. By rotating the knob in one of two directions the handle or handles may be selectively adjusted to different angular positions relative to the housing. This type of arrangement, although quite successful requires however the provision of additional parts, such as the knob, for coupling the handle or handles to the housing. This may prove a rather expensive coupling system in the cost of both parts and labor for assembling them. Further such additional parts are subject to self-loosening and may rather easily become lost.

It is an object of the present invention to provide a portable instrument having a new and improved type of coupling between a handle and a housing for supporting the instrument in a standing position on a surface.

It is another object of the invention to provide a new and improved portable instrument having a housing and a handle, and a coupling between them which can be releasably locked in at least one position of the handle with respect to the housing and is relatively cheap to manufacture and easy to mount.

SUMMARY OF THE INVENTION

According to the invention a portable instrument includes a housing member and a handle member having two cantilevered arm portions coupled to said housing member and means for coupling said handle member to said housing member for rotation relative thereto about an axis. These coupling means include at least one tubular portion having a resilient wall and projecting from one of said members, generally centered on said axis and mounted for relative rotation with respect to the other of said member, and means for releasably locking said handle member and said housing member in at least one housing-supporting position. These locking means include radially disposed camming means on said tubular portion and said other member for mesh-

ing and locking said tubular portion and said other member against rotation when said handle and housing members are subjected to a relative torque less than a given torque, said camming means including at least one camming portion on said resilient wall for pressing said camming portion radially upon the application of a relative torque to said handle and housing members greater than said given torque to permit relative rotation between said tubular portion and said other member. The tubular portion may advantageously be received for rotation in a corresponding opening defined in the other member by an internal wall, said camming means including camming surface portions or lobes on said wall separated by at least one recess in which said camming portion on the resilient wall is lockingly received in the housing-supporting position.

Preferably, the handle and housing members can be made out of a plastic material with the tubular portion integral with the corresponding member. Camming means can be obtained by moulding on the respective members and an inexpensive assembly with a rotatable adjustable handle can thus be manufactured and mounted. The tubular portion may advantageously include a retaining flange portion which can be snapped by forcing it through an opening provided in the other member by elastic deformation of the material constituting the tubular portion and engaging the flange portion past a shoulder around said opening whereby mutual engagement of the flange and shoulder will oppose withdrawal of the tubular portion from the opening thereby eliminating the need for additional parts for mounting the handle to the housing other than the particular integral coupling portions provided thereon. Also, by providing clearances in the portions connecting the tubular portion to the member where it projects from, adjustment may be made of the flexibility of any opposite camming portion formed on the resilient wall of such tubular portion. Preferably the tubular portion projects from one arm of the handle adjacent the end thereof and is received in an opening in one side of said housing and a similar construction is provided between the other handle arm and housing side. In this arrangement, damage from breakage of one tubular portion could be easily repaired by simply replacing the handle, while the housing coupling portions are less subject to deterioration. Lastly several camming portions or detents are preferably symmetrically distributed around the tubular portion for more uniform distribution of stresses therein and better centering upon maneuvering the handle.

Further objects and aspects of the invention will become apparent from the following description of an embodiment given by way of example with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic perspective view of the external part of an instrument embodying the invention;

FIG. 2 is an elevational view of the handle of an instrument such as shown in FIG. 1;

FIG. 3 is an enlarged view of section 3—3 of the handle of FIG. 2;

FIG. 4 is a view of section 4—4 of the handle of FIG. 3;

FIG. 5 is a partial view of a section of the handle and housing coupling assembly of FIG. 1 by a plane containing axis 50 of rotation of the coupling;

FIG. 6 is a view of section 6—6 of the handle and housing assembly of FIG. 5.

DESCRIPTION OF ONE EMBODIMENT

A portable instrument is shown in FIG. 1 having a housing 1 and a handle 2 designed to be coupled to the housing 1 for carrying and supporting it. The housing 1 encloses operating parts, not visible, of an electrical indicating instrument to support and protect them. This housing 1 is mainly constituted by a moulded body 4 of a tough shock resistant plastic material such as glass filled polycarbonate. Integral with the body 4 is a rectangular front panel 11 designed to define a display window 12 and accommodate such control means as a rotatable knob 13 adapted for example to select the sensitivity of the apparatus, and outlets such as 14 adapted to receive plugs or jacks to connect the metering circuitry of the apparatus. Further description of the front panel 11 is not needed to understand the present invention. The housing 1 also has a rear panel, not seen, parallel to the front panel 11, a top wall plate 16 and a parallel bottom wall plate 17, a side wall 18 having an external reinforcing rib 20 extending longitudinally half way between the bottom and top edges 21 and 22 thereof, and an opposite identical side wall 19. The housing 1 has a greater length between front and rear edges 23 and 24 respectively than its width taken between the sides 18 and 19, and the distance separating its top wall plate 16 from its bottom wall plate 17, or thickness thereof, is substantially smaller than its width thus giving a somewhat flattened elongated shape to the instrument as depicted by FIG. 1.

As best seen on FIG. 2 the handle 2 has two substantially parallel arms 30 and 31 connected at ends 32 and 33 by a rectilinear bar 35. Two identical inwardly projecting tubular portions or journals 40 and 41 are integrally formed with the arms 30 and 31 adjacent respective opposite ends 36 and 37 thereof for coupling the handle 2 to the housing 1 by engagement of each portion 40 into an opening 90 formed in the median rib 20 of the housing side wall 18 (FIG. 1). Further detail on the construction of this opening 90 as designed for receiving the tubular portion 40 of arm 30 will be given herein after with particular reference to FIGS. 5 and 6.

As depicted by FIG. 1, the end portion 36 of arm 30 is rotatably mounted in the side wall 18 of the housing at a location slightly offset toward the front part thereof with respect to the middle of the length of the housing and the end portion 37 of arm 31 is mounted in a similar fashion. In the standing position illustrated by FIG. 1, the handle 2 is tilted with respect to the housing 1 so as to form a supporting leg for the front part of the instrument laid on a horizontal surface while the rear part of it is supported by the lower rear edge of the housing contacting the horizontal surface. More specifically, the arms 30 and 31 of the handle form an angle with the longitudinal dimension of the housing while the handle bar 35 connecting these arms extends parallel to the top and bottom plates 16 and 17. In this position the instrument has its front panel 11 inclined on the vertical direction so as to face upwardly in a position where reading of the indications thereof and manipulating of control parts are made easy. The handle 2 can rotate about axis 50 and be brought either into a different tilted position with respect to the housing, or in alignment with the housing, for carrying the instrument, a

sufficient space being provided between the bar 35 and the front panel 11 now facing it for holding the handle.

Each arm 30 or 31 has a flat inward face 38 while the lateral face 39 thereof has a carved portion 42 separating two thicker edges 43 as best seen on FIG. 1, which provide rigidity for the arm. The bar 35 has a series of parallel superposed ribs 44 of decreasing width protruding on the inward face 45 thereof to give the face 45 a profile providing a handy grasp for the fingers of an operator holding the bar 35 to carry the instrument (FIGS. 1 and 2). The handle 2 is of monolithic construction made out of a resilient mouldable plastic material such as a polycarbonate. By virtue of the afore-described construction (FIG. 2) the handle has a better flexibility to bending of arms 30 and 31 parallel to the plane of FIG. 2 than perpendicularly to such plane.

Turning now to FIGS. 3 and 4, a more detailed description of the tubular portion or journal 40 coupling the handle arm 30 to the housing 1 will be given. The tubular portion 40 comprises an annular wall extension 51 projecting at the end 36 of arm 30 (FIG. 4) from the inward face 38 thereof in the direction of the symmetry axis 50 which can be seen for the assembly of FIG. 1 and about which this tubular portion can be rotated once it is coupled to the housing 1. The wall 51 of this tubular portion 40 is relatively thin as illustrated by FIGS. 3 and 4 and by virtue of the resilient properties of the plastic material of which the handle is made, can be resiliently depressed inwardly by applying a sufficient force on the generally cylindrical outer surface 55 thereof while returning its original shape upon release of the deforming force.

The tubular portion 40 defines an internal cylindrical cavity 52 having its axis coincident with axis 50. As shown on FIG. 4, the cylindrical cavity 52 extends through the arm end 36 and has one end 54 which opens into a coaxial circular opening 56 of greater diameter than the diameter of cavity 52 and which is formed in the lateral face of the arm 30 adjacent the end 36 thereof.

Still referring to FIGS. 3 and 4, the tubular portion 40 is integrally connected to the arm 30 by three radial connecting portions 60, 61 and 62 distributed around the outer surface of the annular wall portion 51 and delimited by three arcuate slots 64, 65 and 66 extending parallel to axis 50 through the thickness of arm 30 into opening 56 and having laterally rounded ends, as illustrated at 67 for slot 65 as shown by FIG. 3 separating connecting portions 61 and 62. As best seen on FIG. 4, these slots leave a channel-like clearance between the arm 30 and a corresponding extension 51' of the tubular wall 51 adjacent the end 54 of tubular portion 40. As previously explained, the wall extensions such as 51' are relatively thin and therefore flexible whereas intermediate sections such as 53 of the tubular portion 40 are rigidly attached to the arm 30 by the connecting portions 60, 61, 62 with which they are integrally formed.

Opposite the arm 30, the tubular portion 40 has a free end 70 provided with a generally transverse closure wall 71 closing the cavity 52 opposite to the open end 54 thereof. As shown in FIG. 4, this closure wall 71 is not flat but of slightly conical shape pointing outwardly of said tubular portion in the direction of the axis 50. The closure wall 71 is integrally connected with the end rim of the cylindrical wall 51 so as to de-

fine an annular flange 73 protruding outwardly around the tubular portion 40 at the end 70 thereof and which as will be explained later is designed for retaining the tubular portion 40 within the opening 90 of housing 1 after being inserted therein.

As depicted in FIG. 4 the flange 73 has a frustoconical surface 74 coaxial with wall 51 and outwardly rather steeply inclined on outer surface 55 of this wall 51, facing toward the arm end 36. Facing in the opposite direction the flange 73 has a coaxial frustoconical side surface 75 tapering from circular crestline 73' along which both surfaces 74 and 75 meet toward the outer face of wall 71 forming an angle of about 30° with respect to axis 50.

Intermediate the inwardly looking surface 38 of arm 30 and the annular flange 73 a circular row of three identical arcuate projections or detents 81, 82 and 83 are formed integrally protruding on the outer surface 55 of the resilient wall 51. These three projections are symmetrically distributed around this tubular portion 40 with respect to the axis 50, i.e. at 120° from each other on the periphery of the surface 55. As best seen on FIG. 3 in a cross section by a plane perpendicular to axis 50 each of them is formed by a local thickness increase or bulge in the wall 51 at three locations around the tubular portion 40. The radius of curvature of the cylindrical surface 55 is substantially larger than the radius of curvature of the projections 81, 82 and 83.

Looking now at FIG. 4, it will be observed that the projections 81, 82 and 83 extend only through a fraction of the distance between the surface 38 and the flange 73 in a direction parallel to axis 50. As clearly seen for projection 82 on FIG. 4, these projections have a substantially rectilinear profile parallel to the axis 50 and a clearance is provided between side face 84 of projection 82 and opposite surface 38 of the arm 30. On the other side of the projection 82 a bare annular space 85 is left at the outer surface 55 of the wall 51 between the side face 86 of projection 82 and the surface 74 of flange 73 opposite thereto. The width of said annular space 85 or extent thereof in the direction of axis 50 is sufficient to accommodate a retaining flange in the opening 90 of the housing 91 as explained later. As shown in FIG. 4, the surface 86 is outwardly inclined by about 120° on the axis 50 to form a ramp between the surface 55 and the top surface of projection 82. The other projections 81 and 83 are constructed in the same fashion as projection 82 just described with reference to FIG. 4. In particular, the junction lines between the side faces such as 84 and the wall 51 are circumferentially aligned on the surface 55 and similarly the junctions between the side faces such as 86 and the wall 51 are aligned along a common circumference along the surface 55, i.e., are all located in a common geometrical plane perpendicular to the axis 50.

As depicted in FIG. 3, the slots 64, 65 and 66 have a somewhat greater circumferential length than the projections 81, 82 and 83. Each projection 81, 82 and 83 has the same symmetry plane containing axis 50 as a corresponding one of the slots 64, 65 and 66 in the direction of the axis 50. In other words when looking at the arm end 36 from the free end 70 of tubular portion 40 as illustrated by FIG. 3 (section 3—3 of FIG. 2) each projection appears located opposite the central section of a corresponding slot, the respective peripheral dimensions of slot and projections being in this

case such that each slot encompasses the corresponding projection. To each projection thus corresponds an extension 51' of the wall 51. The tubular portion 41 extending at the end 37 of arm 31 has an identical configuration and construction as that of portion 40.

Turning now to FIGS. 5 and 6, there is shown the opening 90 formed in the side wall 18 of the housing 1 with its symmetry axis on axis 50 already defined in relation to the assembly of FIG. 1. As stated earlier this opening 90 receives the tubular portion 40 of the arm 30 in the mounted assembly of FIG. 1 and it will be understood that another identical opening not seen is provided along axis 50 in the opposite side wall 19 of the casing for receiving the tubular portion 41 of arm 31 thus completing the coupling means between the housing 1 and handle 2. A hollow circular rib 92 is integrally formed at the outer surface of the side wall 18, overlapping the rib 20 and slightly thicker. The opening 90 extends from annular flat brim 98 of said circular rib 92 through the entire wall 18 inside of housing 1 where it opens into a coaxial inner cavity 95 of larger diameter defined by a cylindrical inner wall surface 91 in the inward face of wall 18. Toward the outer side of the wall 18 the opening 90 consists of a cavity 99 bounded by a generally circular coaxial undulated wall surface 93, extending up to the brim 98 of the circular rib 92 as best seen in FIG. 6 and having generatrix lines parallel to the axis 50 as shown by FIG. 5.

The cavities 95 and 99 form two portions of the opening 90 which are delimited by a coaxial inner flange 94 projecting radially inwardly from the wall 18 between cavities 95 and 99. Two longitudinally supporting ribs 96 and 97 are shown on the inner face of wall 18 on either side of opening 90 which are designed for securing the operating parts of the instrument within the housing (FIG. 5).

As shown in FIG. 6 the undulated surface 93 is constituted by a series of alternate lobes 100 and recesses 101 having its axis of symmetry at 50. The innermost portions or tops 102 of the lobes 100 are all tangential to a circle centered on axis 50 and having a radius slightly larger than the radius of outer surface 55 of the resilient wall 51 of the tubular portion 40 to let the free end 70 thereof travel through cavity 99 without substantial friction of the terminal flange 73 against the surface 93. The radius of this circle is however smaller than the distance from the axis 50 to the outermost surface of each of projections 81, 82 or 83 of tubular portion 40 (see FIG. 6). The bottoms of recesses 101 separating adjacent lobes 100 are rounded and the transition surface sections between the successive lobes and recesses provide a fairly smoothly and continuously undulated profile for surface 93. The recesses 101 are designed and shaped to receive the projections or detents 81-83 when the tubular portion 40 is engaged in the opening 90 and, although the outermost portion of a projection or detent lodged in a recess does not necessarily contact the bottom of such recess the projection has two lateral sections thereof on either side of its outermost portion in engagement with two corresponding transition surface sections on either side of the recess in which it is lodged as shown on FIG. 6.

In the presently described example there are twelve recesses 101 distributed around the undulated surface 93 so that one out of four recesses 101 may accommodate a different one of the three projections 81-83 when the tubular portion 40 is engaged in opening 90

and each of these filled recesses tends to lock the projection therein against rotation without substantially, radially deforming the wall 51 of portion 40, both transition surface sections on the sides of each recess providing stops for the corresponding projection.

Returning to FIG. 5, the flange 94 has two opposed lateral side faces 104 and 105 respectively facing outside and inside the housing 1. These side faces 104 and 105 project in the opening 90 perpendicularly to the axis 50 and are bounded inwardly by an inner cylindrical surface 106 centered on axis 50. The radius of this cylindrical inner surface 106 is just sufficiently larger than that of outer surface 55 of the tubular portion 40 on the handle to let the annular space 85 adjacent the free end 70 of this portion 40 pass through the flange and rotate freely within inner surface 106 thereof. The radius of this surface 106 is in the present example slightly smaller than the distance from axis 50 to the innermost portion 102 of the lobes 100 of the undulated surface 93 as can best be seen by profile of flange inner surface 106 on FIG. 6 which is not quite tangential to the innermost portions 102 of the lobes 100. The radius of this flange inner surface 106 also is smaller than the distance from the axis 50 to the outermost surface of projections 81, 82 and 83 so that the side faces 86 of the row of projections would abut against side face 104 of the flange 94 upon engagement of tubular portion 40 into opening 90 further than in the position of FIG. 5. Lastly, the radius of inner flange surface 106 is also smaller than the radius of the crestline 73' of the retaining flange 73 on portion 40, but slightly greater than that of the terminal portion of frustoconical flange surface 75 so that when the portion 40 is introduced into the opening 90, the frustoconical flange surface 75 first abuts against the side face 104 of the flange 94, then upon exerting sufficient inward force can overcome the obstacle created by flange 94 by elastic inward deformation of the flange 73 on resilient tubular portion 40 to emerge into cavity 95 (FIG. 5) which has greater diameter than that of crestline 73' and wherein flange 73 recovers its original shape. In this position, the bare annular space 85 of outer surface 55 of wall 51 rests within the cylindrical inner surface 106 of flange 94 which throttles the opening 90 between cavities 95 and 99 as seen on FIG. 5 which shows the tubular portion 40 of arm 30 engaged in the opening 90 in the casing 1.

The thickness of flange 94 in axial direction is practically equal to the width of the annular bare space 85 on surface 55 extending between the faces 86 of the projections 81, 82 and 83 on one hand and the base of the inclined surface 74 of the retaining flange 73 on the other hand. In the position shown in FIG. 5 relative movement of the tubular portion 40 and the housing 1 parallel to the axis 50 is substantially prevented in either direction. In this position, the flat face 38 of arm 30 abuts against brim 98 of rib 92, and surface 74 abuts against side face 105 of flange 94 preventing the arm 30 from being normally pulled out of engagement in the housing 1. Due to the sharp inclination of surface 74 on the outer cylindrical surface 55, which may be in the order of 45°, a much stronger pull would be necessary to disengage the free end 70 from the retaining action of flange 94 in order to withdraw portion 40 from opening 90 than to insert it into retaining engagement therein by forcing frustoconical surface 75 which is in-

clined by about 30° only on axis 50 through the throttling flange 93 as explained earlier.

As explained before, when the arm 30 is being mounted to the housing into the position illustrated by FIG. 5, by introducing the tubular portion 40 all the way through the opening 90, each of the projections 81, 82 and 83 of the tubular portion 40 can be laterally inserted into a different one of the twelve recesses 101 by proper selection of the angular position of the arm 30 relative to the housing 1. The projections 81-83 received in respective recesses 101 tend to hold the arm against rotation relative to the housing, while relative outward axial movement is prevented as explained above. If a torque is applied to rotate the arm 30 with respect to the housing these projections tend to be driven against the transition surface sections bounding the recess to climb along the adjacent lobe 100 and to come out of the respective recesses 101 wherein they are lodged. As the distance between the axis 50 and the innermost surface 102 of lobes 100 is smaller than the distance between the axis 50 and the outermost surfaces of these projections 80, 81 and 82 such rotation can only be achieved upon application of a sufficient torque to press the projections 81-83 inwardly substantially radially causing elastic deformation of the thin resilient wall 51. This inward deformation results from a camming action upon relative movement of projections 81-83 and lobes 100. The deformation reaches a maximum when the top surfaces of projections 81-83 and lobes 100 are opposite and then decreases upon continuing rotation while the deformed wall 51 tends to resiliently displace the projections outwardly thus snapping them into a recess 101 next to the one they just left wherein they recover their initial radial position. Due to the suitable shaping and dimensioning of the recesses 101 with respect to the arcuate projections, once the projections are received in these recesses they tend to remain in this position substantially without play to retain the arm 30 against movement of rotation with respect to the housing as long as a torque of magnitude greater than a given threshold has not been applied thereto. As stated, rotation about axis 50 is the only movement permitted to the arm 30 relative to the housing 1 by virtue of the particular mounting just described.

The provision of three symmetrical projections results in more uniform distribution of stresses with the cylindrical wall 51 upon rotating the handle 2 and better centering of the tubular portion within opening 90. It should be observed that while the tubular portion 40 is rotated with consequent depressing of the projections 81-83, the bare annular space portion 85 of outer surface 55 may occasionally bear against the inner cylindrical surface 106 of flange 94 thus providing some additional guidance to the rotating movement of portion 40.

What has just been explained with reference to arm 30 also applies to arm 31 and thus to the handle 2 which can be set in a plurality of discrete positions with respect to the housing and required a given torque to be switched from one position to the next. As there are twelve recesses in each of the openings in the housing side walls 18 and 19, the handle can take theoretically twelve different angular positions relative to the housing. In one of these positions the handle arms 30 and 31 extend parallel to the longitudinal dimension of the housing with the bar 35 opposite the front panel 11 in

a position suitable for carrying the instrument. By tilting the handle so as to move the bar 35 underneath the plane of the bottom wall plate 17 a variety of positions may be found where the instrument is supported as illustrated in and described with reference to FIG. 1.

It will be recalled here that the slots 64-66 provide wall portions 51' having good flexibility as extensions of the resilient wall portion 51 within the arm end 36, each of these wall portions 51' being opposite a respective projection 81-83. The provision of these slots improves the bending ability of the wall 51 around each projection 81-83. The thickness of the wall 51 for a given plastic material out of which the handle is made and the dimensions of the slots 64-66 are selected so as to adjust the stiffness of the wall 51 around the projections to enable rotation of the handle with respect to the housing without necessitating an unduly great effort from an operator manipulating the handle (such handle acting as a lever) on the one hand and to obtain a retaining force in each discrete tilted position of the handle where the projections 81-83 are engaged in respective recesses which is sufficient to support the instrument. In particular, when the instrument is laid down on a horizontal surface with its rear part resting on this surface and its front part supported by the handle set at an angle with respect to the housing convenient for the operator (FIG. 1), the retaining force provided by the resilient wall 51 to resist forces pressing down the projections 81 through 83 as a result of the torque exerted on the handle by the instrument's own weight must be sufficient to prevent said handle from rotating and the instrument stand from collapsing.

The housing and handle may be moulded, the handle being one piece including all elements described for the handle bar 35, arms 30, 31 and tubular portions 40 and 41. The corresponding parts of the coupling means in and around openings such as 90 are all integral with the housing 1. The handle 2 can be very easily mounted in assembly with the housing by simply snapping each of the tubular portions 40 and 41 into the respective coaxial openings in the side walls 18 and 19. The slightly conical shape of the closure wall 71 facilitates immediate correct positioning of the free end 70 in the outer entrance of opening 90 before pushing the end 36 or 37 of the respective arms inwardly to engage the flange 73 within cavity 99. Due to the frustoconical shape of the surface 75 at the free end 70 of each of these annular portions 40 and 41, the retaining flange 73 can then be forced through the restricted opening defined by the inner surface 106 of flange 94 and owing to the resiliency of the material forming portions 40 and 41 be driven through such restricted opening to the position depicted in FIG. 5. Once in this position it is difficult to remove the tubular portions 40 and 41 from their respective coupling engagement within cavities 90 in the housing. The inclined surface 74 of the retaining flanges 73 engaged against the shoulder provided by side face 105 of the flange 94 can help in resiliently maintaining the flat inner faces 38 of the arm 30 at the respective end 36 thereof in tight engagement against the flat brim 98 at the entrance of opening 90 upon snapping the retaining flange 73 through the flange 94. Thus axial play of the arm ends is not permitted in either direction along axis 50. The tight engagement of the arms inner face 38 against the brim 98 somewhat protects the rotatable coupling against entry of foreign matters inside the casing and the closure wall 71 also

prevents such entries inside the housing by closing one end of the cavity 52 which as will be recalled has its end 54 open adjacent the lateral face 39 of the arm.

It should be noted here that due to the resilient nature of the material with which the handle 2 is manufactured the arms 30 and 31 of this handle can be easily moved apart at the mounting stage to bring their respective tubular portions 40 and 41 in front of the respective cavities 90 in the sides 18 and 19 of the housing. The arms can be then pushed back inwardly with respect to each other in order to force these tubular portions in engagement with the housing as explained above.

Accordingly it will be apparent that a portable instrument has been provided having a housing and a handle rotatably secured to said housing by a coupling of very simple construction and requiring a minimum number of parts. As explained the various parts of this coupling can be integrally formed with either the handle or the housing and the assembly of the handle and housing can be readily made by simple engagement of one with the other without any need for an intermediate part. According to the invention, this particular coupling not only provides a rotatable connection between the handle and the housing but also one which permits to maintain the handle at a desired angle in various discrete positions with respect to the housing without the need for additional adjustment such as by tightening a screw or the like, particularly with a view to use this handle as a supporting leg for the instrument standing on a horizontal surface. Also, in addition to providing inexpensive and easy to manufacture means to achieve such a connection, the invention provides means previously disclosed for making optimum use of the resiliency of the material which can be used for making the coupling parts and more specifically to adjust the degree of stiffness by which said handle is retained in its various positions with respect to said housing.

While a preferred embodiment has been previously described to illustrate the invention it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the spirit thereof.

I claim:

1. A portable instrument comprising:

a housing member for receiving operating parts of said instrument;

a generally U-shaped handle member for carrying and supporting said instrument in a standing position on a surface, said handle member having two cantilevered arm portions; and

means mounted adjacent the extremity of each arm portion for coupling said handle and housing members for relative rotation therebetween about an axis,

at least one of the coupling means including

a resilient tubular element, radially inwardly yieldable, generally centered on said axis and projecting from one of said members,

the other of said members including at least one generally circular internal wall centered on said axis and defining an opening in which said tubular element is received and bears against said internal wall for rotation about said axis, and

means for releasably locking said handle member on said housing member in at least one housing-supporting position, including an outwardly pro-

jecting section at the outer periphery of said resilient tubular element and a camming surface section adjacent to a recessed section at the inner periphery of said internal wall,

the distance from said axis to the outermost surface of said projecting section being greater than the distance from said axis to said camming surface section of said internal wall adjacent to said recessed section,

said projecting section being received in said recessed section to bear against said camming surface section in said at least one housing-supporting position for locking said tubular element against rotation with respect to said internal wall when said tubular element is subjected to a relative torque smaller than a given value, in one direction from said at least one housing-supporting position, and

said projecting section being cammed inwardly into said resilient tubular element by deformation thereof when forced against said camming surface section upon said tubular element being subjected to a relative torque greater than said given value to disengage said projecting section from said recessed section in said one direction and to shift said handle and housing members from said at least one housing-supporting position to another relative position.

2. The apparatus of claim 1 wherein said resilient tubular element is integral with and projects from said handle member and said opening is defined in a side portion of said housing member.

3. The portable instrument of claim 1 wherein said resilient tubular element is connected to said one member by means of at least one connecting portion extending over only a fraction of the periphery of said resilient tubular element to leave a clearance between said resilient tubular element and said one member, which clearance is substantially aligned with said outwardly projecting section parallel to the direction of said axis.

4. The portable instrument of claim 3 wherein one end of said tubular element is open adjacent to said one member and said clearance, and the other end of said tubular element away from said one member is closed by an integral wall transverse to said axis.

5. The apparatus of claim 1, wherein said tubular element has a substantially circular cross section, said outwardly projecting section is one of a series of external arcuate projections circumferentially distributed at the outer periphery of said tubular element, and said camming surface section is one of a plurality of inwardly directed lobes spaced about said opening at the periphery of said internal wall and separated by arcuate recesses one of which includes said adjacent recessed section, each one of said arcuate projections being received in one of said arcuate recesses in said at least one housing-supporting position of said handle and housing members.

6. The portable instrument of claim 5, further comprising:

an annular retaining flange adjacent a free end of said tubular element away from said one member, having a first inclined side face of tapering cross section toward said free end and a second side face

facing said one member in the opposite direction;

an annular space at the outer surface of said tubular element between said retaining flange and said plurality of arcuate projections around said tubular element; and

a shoulder defined by said internal wall around said opening and engaging the second side face of said retaining flange to prevent withdrawal of said tubular element from said opening, the diameter of said opening at said shoulder being smaller than the maximum diameter of the first side of said retaining flange but larger than the minimum diameter thereof, whereby said tubular element can be mounted by forcing the free end thereof through said opening upon resilient deformation of said flange for passing said shoulder.

7. The portable instrument of claim 6 wherein said handle and housing members have respective opposite surfaces engageable for limiting axial penetration of said tubular element into said opening, and said second face of said retaining flange is inclined at an obtuse angle on the surface of said annular space for resiliently engaging said shoulder once the first inclined surface of said flange has passed said shoulder to urge said opposite engageable surfaces in mutual contact whereby axial relative movement of said members is prevented.

8. A portable instrument comprising a housing member for enclosing operating parts of the instrument, a handle member having two joined arm portions for carrying the instrument and supporting it in a standing position on a bearing surface, and means adjacent the extremities of said arm portions for coupling said handle and housing members for relative rotation about an axis comprising:

at least one resilient tubular wall projecting from one of said members and integral therewith, generally centered on said axis;

mounting means for substantially preventing relative axial movement in at least one direction between said tubular wall and the other of said members while permitting relative rotation therebetween about said axis; and

interlocking surface portions on said tubular wall and said other member for yieldably locking said handle and housing members against rotation in a plurality of relative angularly displaced locking positions, including a plurality of radially yieldable detent surface portions spaced about said axis on said resilient tubular wall and a series of substantially non-deformable spaced apart camming surface portions disposed about said axis on said other member opposite the surface of said resilient tubular wall, with each one of said detent surface portions radially facing a section of said other member intermediate two respective adjacent ones of said camming surface portions in each one of said angularly displaced locking positions,

said respective adjacent camming surface portions extending radially for providing stops against angular displacement on either side of each one of said detent surface portions facing said intermediate sections in said angularly displaced locking positions to prevent relative rotation of said members when subjected to a relative torque smaller than a given torque, and for camming and pressing radi-

ally said yieldable detent surface portions by deforming said resilient wall when said detent surface portions are brought opposite one of said respective adjacent camming surface portions upon application to said members in one of said angularly displaced locking positions of a relative torque greater than said given torque to permit relative rotation thereof toward another of said angularly displaced locking positions.

9. The instrument of claim 8 wherein said mounting means include a flange portion on said tubular wall having an inclined side face tapering toward the end of said tubular wall opposite said one member and an opposite side face, and an internal wall in said other member defining an opening centered on said axis in which said tubular wall portion is rotatably received, and said internal wall forming a shoulder around said opening for abutting against said opposite side face of said flange portion to prevent withdrawal of said tubular wall from said opening, the transverse dimension of said opening being intermediate between the maximum and minimum transverse dimensions of said inclined side face of said flange portion so as to permit introduction of said tubular wall portion into said opening by forcing said inclined side face through said opening past said shoulder upon elastic deformation of said flange portion on said resilient tubular wall.

10. The instrument of claim 8, wherein said radially yieldable detent surface portions are inwardly yieldable at the outer surface of said resilient tubular wall and said camming surface portions are formed around the inner periphery of a generally circular internal wall centered on said axis and defining an opening in said other member wherein said resilient tubular wall is received for rotation about said axis.

11. A portable instrument comprising:

a housing for receiving operating parts of the instrument;

a monolithic U-shaped handle of a resilient material coupled to said housing for hand carrying the instrument and for providing a stand for this instrument on a flat surface, said handle having first and second arms and a bar connecting said arms at one end thereof; and

means for coupling said handle to said housing for rotation relative thereto about a common axis comprising:

first and second tubular portions respectively projecting inwardly of said arms adjacent the other ends thereof in axial coalignment, each of said tubular portions including:

a generally cylindrical coaxial resilient wall having one open end, and a free end away from said respective arm,

a plurality of separate connecting portions for connecting said cylindrical wall to said respective arm, said connecting portions distributed around the periphery of said cylindrical wall adjacent the open end thereof, and separated by arcuate slots leaving a clearance between said cylindrical wall and said arm,

an integral wall closing said free end,

a first coaxial retaining flange projecting outwardly of the surface of said cylindrical wall at the free end thereof, said first retaining flange having one side face facing toward said respec-

tive arm and an opposed side face tapering toward said free end, and

a series of external arcuate projections distributed circumferentially around said cylindrical wall intermediate said first retaining flange and said respective arm, each of said arcuate projections being in alignment with one of said arcuate slots in the direction of said axis;

said housing having first and second concentric cavities formed therein which are defined by two respective coaxial internal housing wall surfaces against each of which a respective one of said first and second tubular portions bears for rotation about said axis;

camming surface sections on each of said wall surfaces separated by arcuate recesses formed therein, the recesses being shaped to accommodate said projections on said respective cylindrical wall and the distance from said axis to the outermost surface of each of said projections being greater than the distance from said axis to said camming surface sections, whereby said projections are pressed inwardly within a section of said resilient cylindrical wall aligned with a corresponding one of said slots when opposite said camming surface sections of said internal housing wall surface, and are displaced outwardly when opposite said recesses to lock the handle against rotation in at least one housing-supporting position; and

a second flange on each of said internal wall surfaces radially projecting within the respective cavity and having two opposed lateral faces, one oriented toward said camming surface sections and recesses and the other facing inside said housing, and a circular concentric inner wall surface opposite a portion of said respective cylindrical resilient wall confined between said series of arcuate projections and said first retaining flange;

each of said arms abutting axially inwardly against said housing for limiting the penetration of the respective tubular portion within said respective cavity and said one side face of said respective first retaining flange abutting axially outwardly against said lateral face of said respective second flange facing inside said housing for preventing withdrawal of said respective tubular portion from said respective cavity; and

the maximum outer diameter of said opposed tapering side face of each said first retaining flange being greater than the diameter of said inner wall surface of said corresponding second flange and decreasing to a value less than the diameter of said inner wall surface toward said free end of said respective cylindrical wall whereby the corresponding arm of said handle can be mounted in said housing by forcing said first retaining flange at the free end of said resilient cylindrical wall through said inner wall surface of said second flange upon resilient deformation of said first retaining flange.

12. A portable instrument comprising a housing member for enclosing operating parts of the instrument, a handle member having two joined arm portions for carrying the instrument and supporting it in a standing position on a bearing surface, and means adjacent the extremities of said arm portions for coupling said

handle and housing members for relative rotation about an axis comprising:

at least one resilient tubular wall projecting from one of said members and integral therewith, generally centered on said axis;

mounting means for substantially preventing relative axial movement in at least one direction between said tubular wall and the other of said members while permitting relative rotation therebetween about said axis, said mounting means including

a flange portion on said tubular wall having an inclined side face tapering toward the end of said tubular wall opposite said one member and an opposite side face, and

an internal wall in said other member defining an opening centered on said axis in which said tubular wall portion is rotatably received, said internal wall forming a shoulder around said opening for abutting against said opposite side face of said flange portion to prevent withdrawal of said tubular wall from said opening, the transverse dimension of said opening being intermediate between the maximum and minimum transverse dimensions of said inclined side face of said flange portion so as to permit introduction of said tubular wall portion into said opening by forcing said inclined side face through said opening beyond said shoulder upon elastic deformation of said flange portion on said resilient tubular wall; and

interlocking surface portions on said tubular wall and said other member for yieldably locking said handle and housing members against rotation in at least one housing-supporting position, including at least one substantially radially yieldable detent surface portion on said resilient tubular wall and at least one camming surface portion on said other member for providing a stop for said detent surface portion in said housing-supporting position to prevent relative rotation of said members when subjected to a relative torque smaller than a given torque, and for pressing said yieldable detent surface portion by substantially radially deforming said resilient wall upon application of a relative

torque to said members greater than said given torque to permit relative rotation thereof.

13. A portable apparatus housing for coupling to a rotatable handle lockable in at least one angular position with respect to the housing for providing a stand for the apparatus on a flat surface, comprising a hollow housing body including two sidewalls on opposite sides thereof, said sidewalls respectively having inner and outer faces and internal walls formed therebetween, said internal walls defining two respective generally circular bores through said sidewalls, centered on a common axis and adapted for rotatably receiving a journal portion of the handle, each said internal wall comprising: a first cylindrical wall section of undulated transverse cross section terminated at one end thereof by a plane edge section on the outer face of the respective sidewall of the hollow housing body, said first wall section defining a series of inwardly projecting lobes separated by arcuate recesses distributed on said first wall section around said axis; and a second cylindrical wall section of circular transverse cross section centered on said axis, having one end thereof adjacent to said first section and terminated at the other end thereof by a circular shoulder section on the inner face of said respective sidewall, the radius of said second wall section being smaller than the radial extent of the outermost surface of said arcuate recesses, whereby a substantially U-shaped handle having two arms with two respective inwardly directed cylindrical journal portions adjacent the end thereof, each journal portion terminated by a retaining flange at one free end thereof and including at least one surface section projecting outwardly on the journal portion and shaped to be received in said arcuate recesses, can be rotatably coupled to said housing body by forcing the retaining flange of the journal portions thereof through a respective one of said bores beyond said shoulder section and can be locked with respect to said housing in one of a plurality of angularly adjustable positions upon insertion of the aforementioned outwardly projecting section in a corresponding one of said arcuate recesses.

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