United States Patent

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[54] **VARIABLE LENGTH COMPENSATING LEVER LATCH HANDLE MECHANSIM**
5 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **312/320,** 312/215
[51] **Int. Cl.** **A47b 88/00,** A47b 95/02
[50] **Field of Search** ..... 312/320, 215; 211/41; 339/45; 74/519 T

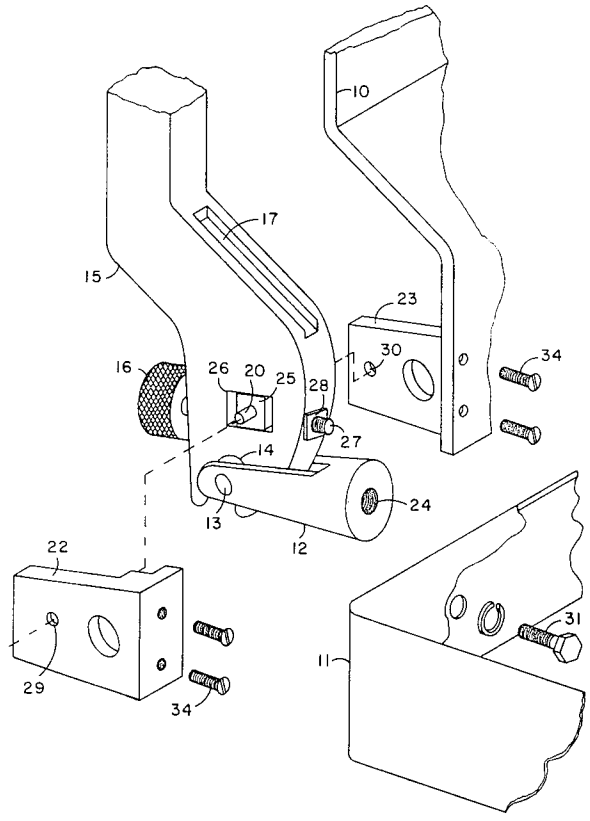
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ABSTRACT: A cam-lock handle to facilitate insertion, extraction, and holddown functions between a demountable equipment or device and its container or mounting base includes an operational variable pivot point assembly for the handle by means of which the mechanical advantage of the handle may be varied to optimize handle functions and ready adjustment for variations in equipment lengths is permitted.



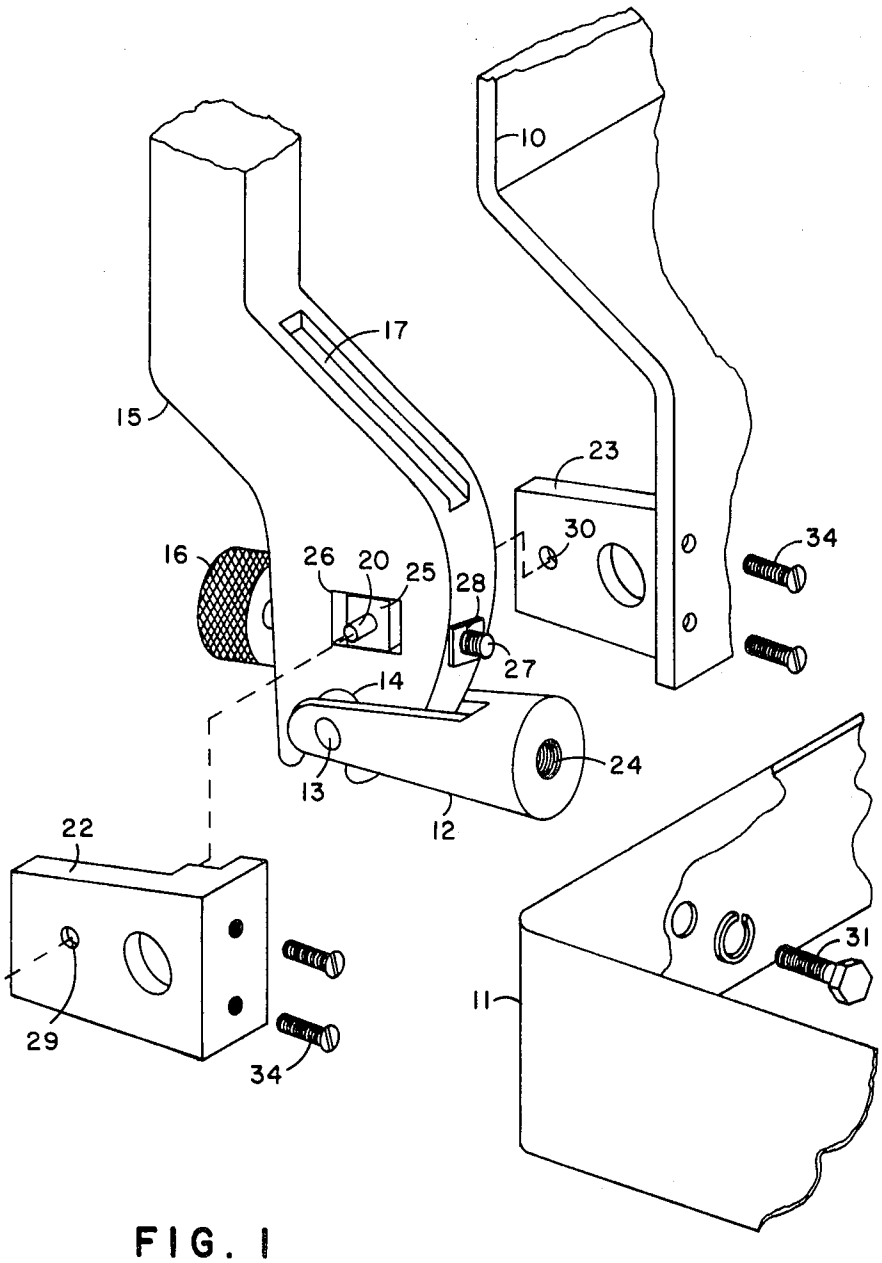


FIG. 1

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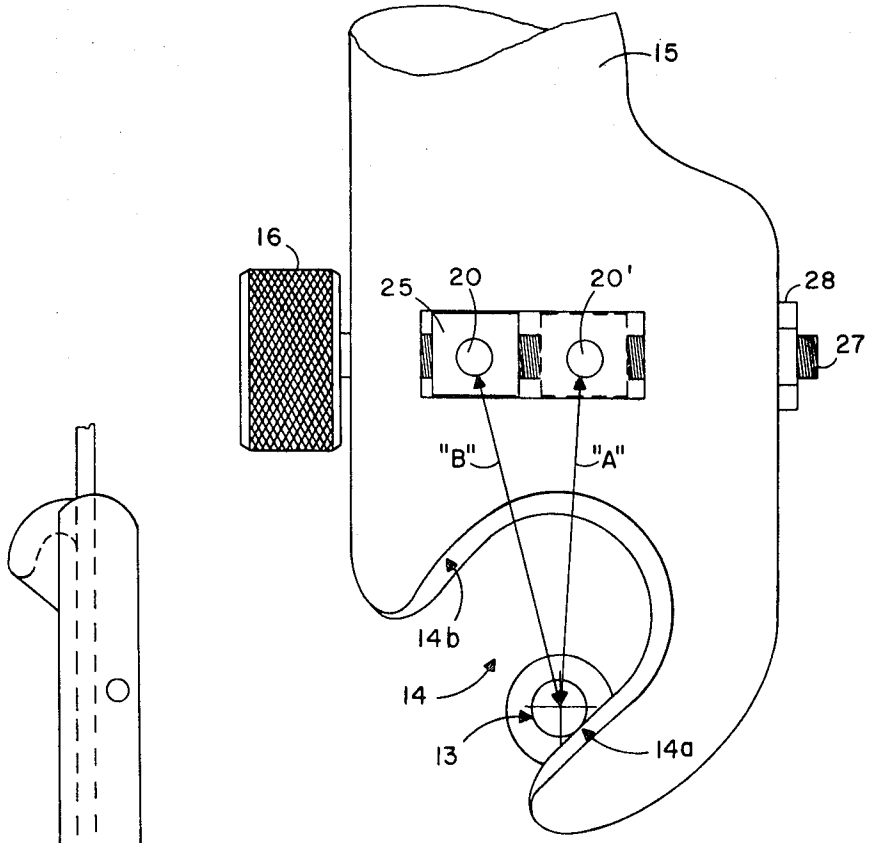


FIG. 3

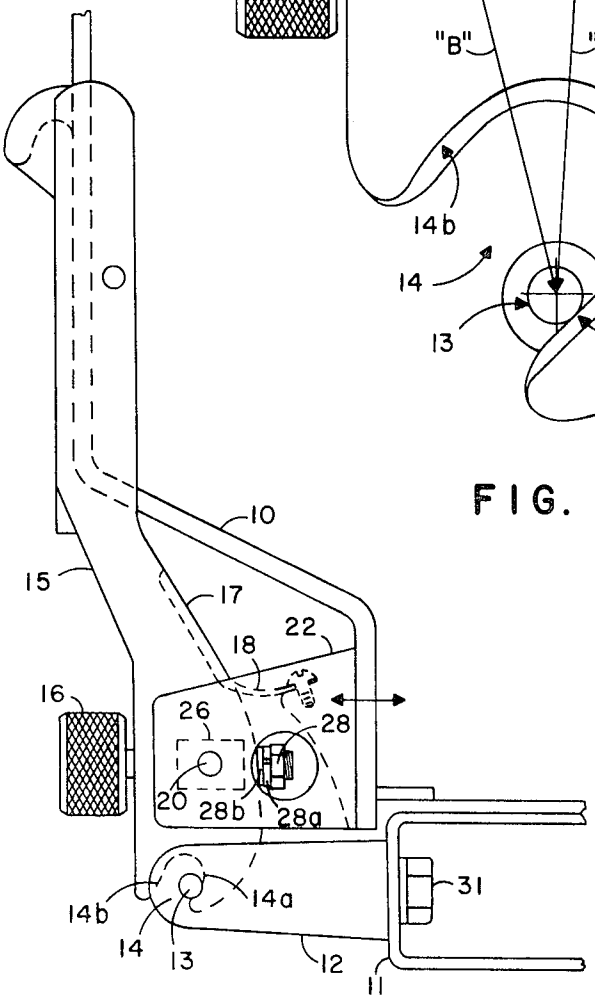


FIG. 2

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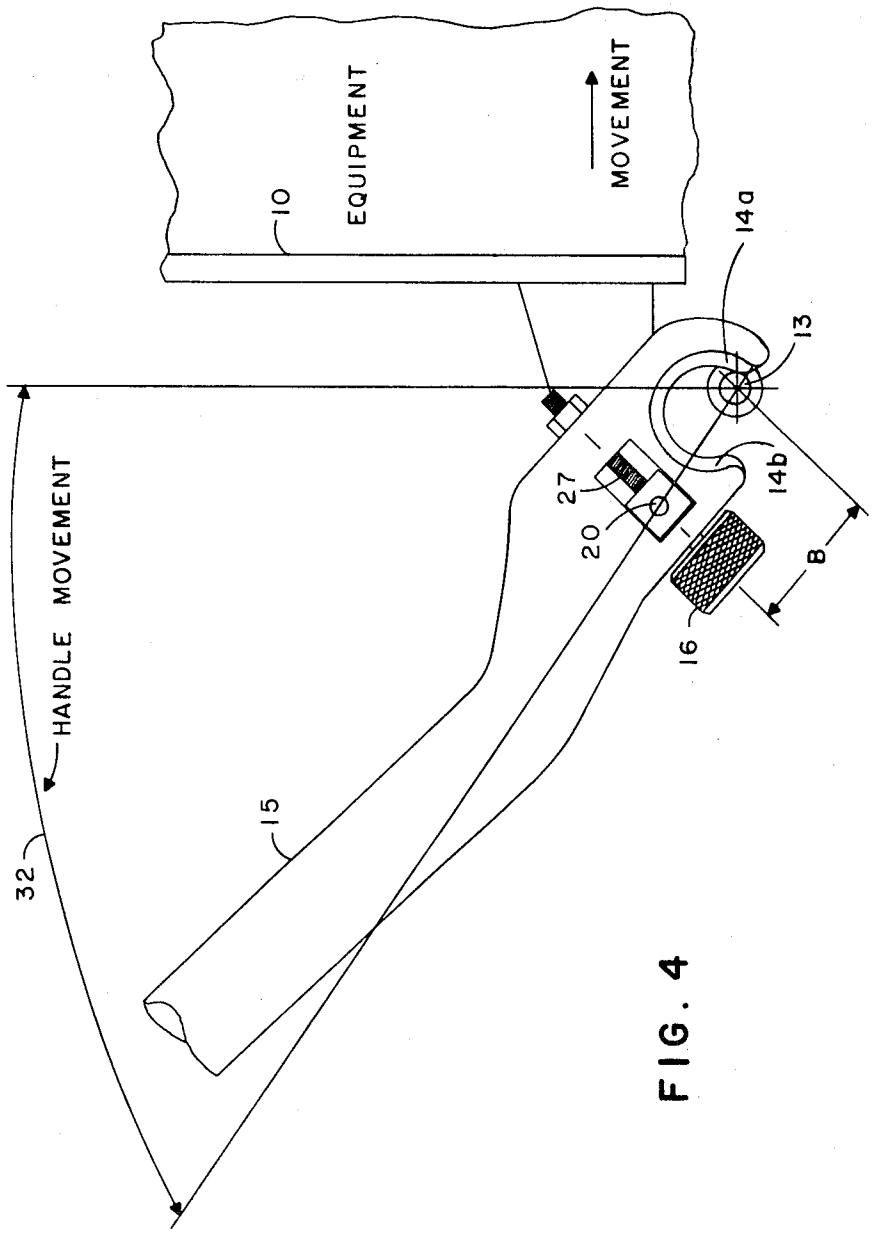


FIG. 4

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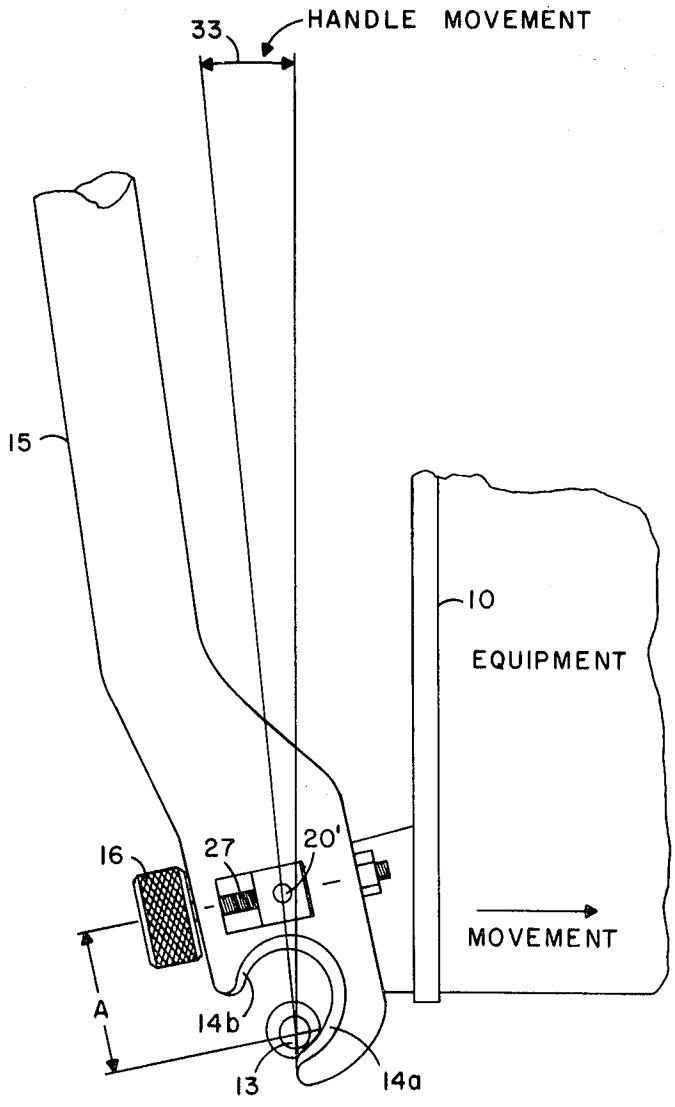


FIG. 5

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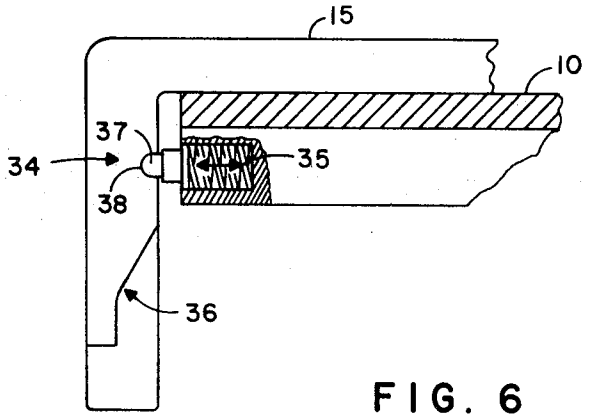


FIG. 6

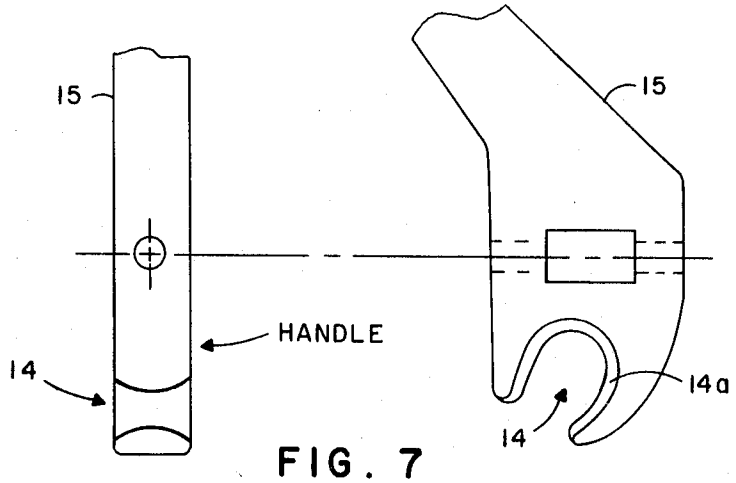


FIG. 7

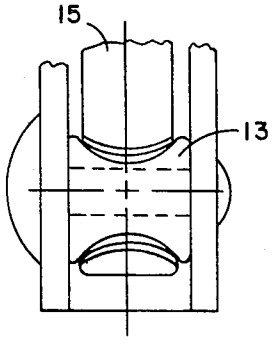


FIG. 9

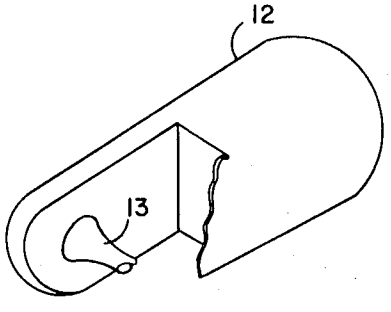


FIG. 8

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VARIABLE LENGTH COMPENSATING LEVER LATCH HANDLE MECHANSIM

This invention relates generally to latching mechanisms and more particularly to an improved latching mechanism for optimizing insertion, extraction, and holddown capabilities of an equipment contained in a mounting base or rack.

More particularly the present invention relates to an improvement in latching and holddown means for mounting and removal of an electronic equipment from a mounting base wherein numerous plug-jack electrical connections are to be completed or disconnected as the equipment is installed or removed respectively.

Stringent requirements must be met for the mounting of airborne or otherwise mobile electronic assemblies in mounting racks or bases where units must be securely held and a solid mount maintained under the influence of a highly vibrational atmosphere and in the application of various randomly directed shock forces.

Electrical interconnection between unit and mount may also entail the mating and insertion of a multiplicity of electrical plugs and sockets such that considerable frictional forces are encountered during insertion and extraction of the equipment from its mount.

Among numerous designs employed to facilitate mounting and "holddown" is the cam-lock type of handle. The cam-lock handle aids insertion and disconnect operations by providing a lever action between a cam lobe and a locking pin with mechanical advantage defined by dimensional interrelationship between camming surface, the handle pivot point, and the handle length.

Problems occur, however, with the cam-lock type of handle. The relationship of the handle pivot point to the cam portion of the handle assembly is extremely critical to proper insertion-extraction and holddown capabilities of the handle. Inherent tolerances in equipment lengths and the desirability and necessity for interchangeability of units in a permanently mounted rack or base are incompatible conditions as concerns a cam-lock type of latching mechanism wherein the handle pivot point is fixed. In the absence of a means to adequately compensate or adjust for allowable tolerance in the length of units to be mounted, adjustment of a cam-lock type of assembly becomes difficult and unpredictable and may involve a time-consuming adjustment of the clevis pin latch location with respect to the locking cam.

The object of the present invention is the provision of a cam-lock type of handle assembly for cooperation with a fixed clevis or locking pin which incorporates novel adjustment means permitting movement of the handle pivot point as required to adjust to variations in lengths of equipments to be mounted or inserted.

A further object of the present invention is the provision of a novel length compensating lever latch handle mechanism for cooperation with a fixed clevis pin latch assembly wherein the mechanical advantage of the locking handle assembly is selectively variable on an operational basis, as contrasted to a preset basis.

A still further object of the present invention is the provision of a latching handle mechanism wherein the mechanical advantage of the device is selectively variable and may be readily adjustable to be greatest as the equipment to be inserted nears maximum engatement where loads are greatest.

Still another object of the present invention is the provision of a latching handle mechanism providing a selectively variable mechanical advantage extracting-inserting mechanism the use of which optimized insertion-extraction operations and which provides an optimized locked holddown between inserted unit and mounting base respectively.

The present invention is featured in provision of a handle mechanism employing first and second cam lobes for use in insertion and extraction operations respectively operated by pivotable movement of a handle mechanism the pivot point of which may be selectively adjusted along a line substantially transverse of the longitudinal axis of the handle member.

A further feature of the present invention is the provision of means for selectively increasing to a predetermined maximum value the force exerted against the clevis or holddown pin by the locking cam lobe after the handle mechanism is in locked position.

These and other features and objects of the present invention will become apparent upon reading the following description with reference to the accompanying drawings in which:

FIG. 1 is an exploded isometric view of a latching handle mechanism in accordance with the present invention;

FIG. 2 is a side view of the latching handle mechanism in locked position;

FIG. 3 is a diagrammatic view of the variable mechanical advantage features of a handle mechanism in accordance with the present invention;

FIGS. 4 and 5 are diagrammatic representations of relative positions of handle and locking pin illustrating insertion capabilities for respective extreme pivot point adjustments;

FIG. 6 is a partial view illustrating a detented handle-locking feature of the present invention; and

FIGS. 7, 8, and 9 illustrate cam surface configuration and clevis pin shaping as employed in the present invention.

The cam-lock type of handle has been employed in the art as a convenient means for inserting and disconnecting equipments from mounting racks or receptacles. The cam-lock of handle is essentially a lever application where the fulcrum is the pivot point of the handle and the mechanical advantage of the lever is defined by the point of application of a rotational force on the handle and the lever arm distance between the pivot point and the point of engagement between the handle camming surface and a fixed locking pin or clevis.

In general, rotation of the cam-lock handle about its pivot axis, through the cooperative engagement of a camming hook with a holddown pin causes relative motion to be imparted between the equipment and its mounting base, and the mechanical advantage of the handle determines the ease and efficiency with which the injection and rejection function is accomplished.

As mentioned above, considerable force must often be applied when inserting electronic equipment into a rack due to the high frictional forces imposed by the "making" of multiple pin-socket connections. Alternatively, ejection and withdrawal of the equipment necessitates a considerable force to be applied to "break" the frictional holding forces imposed by the pin-socket connections. The cam-lock type of handle, in addition to providing a mechanical advantage for accomplishing the insertion and ejection of equipments into mounting bases, provides, in its "closed" position, a holddown or lock means which might be generally compared to that of a hook and a pin arrangement. The equipment is thus protected from vibration and shock loads when the handle is in the lock position.

The present invention uniquely accomplishes the known advantages of the cam-lock type of handle and provides a decided improvement in permitting a simple operator adjustment to adapt a locking handle assembly carried on an equipment with a particular mounting base. As above described, it is oftentimes desired to interchange electronics equipments in a common mounting base, and, due to tolerances in equipment length, the cam-locking handle may give rise to time-consuming and unpredictable misalignments between the handle and the base-mounted clevis pin latch assembly. The operation of a cam-lock handle is based on a relationship of the handle pivot point to the cam portion of the handle assembly, and this relationship is critical to the proper insertion-extraction and holddown capabilities. The present invention provides a unique variable handle pivot point such that the operator may easily adjust a given cam-lock handle assembly for optimized cooperation with a fixed clevis or locking pin on the equipment mounting base.

FIG. 1 illustrates a handle mechanism in accordance with the present invention used to insert or extract a unit 10 from a cooperating mounting base 11. It is to be realized that the unit

10 might be a piece of electronic gear in a boxed enclosure for attachment with a mounting base 11 or, alternately, unit 10 might be the chassis of an electronic equipment and the mounting base 11 comprise a fixed cabinetlike receptacle into which the equipment is to be inserted and extracted in drawer-like fashion. As illustrated in FIG. 1, the handle 15 is shown in a locked position with respect to a locking pin or clevis member 13, and the equipment 10, with respect to which the handle assembly is pivotably mounted, is illustrated as being in a fully inserted relationship with respect to the mounting base 11. The locking pin 13 extends transversely through a slotted mounting dog 12 which might be rigidly affixed to the front surface of the mounting base 11 by means of a threaded hole 24 in the dog and a mounting bolt 31. The slot accommodates the handle member into engaged camming relation with the locking pin 13. The handle 15 is illustrated as having a longitudinal offset between the upper portion of the handle and the bottom camming extreme purely as a design expedient to provide a flush arrangement upon being placed in locked position; that is to say, the handle shape conforms with the offset front panel shape of the unit 10 to which it is attached such that, as better illustrated in FIG. 2, under a fully inserted and locked arrangement, the camming mechanism does not protrude ahead of the front face of the mounted equipment.

The handle 15 (referring again to FIG. 1) is pivotably mounted with respect to first and second handle brackets 22 and 23. These brackets are rigidly affixed, using mounting screws 34, to the front panel 10 of the unit to be mounted. The pin 20 associated with the handle 15 is thus rotatably or pivotably mounted with respect to through-holes 29 and 30 in the respective mounting brackets 22 and 23.

Referring to FIG. 2, and considering for the moment that the pivot pin 20 associated with the handle 15 bears a fixed relationship with respect to the handle 15, it is seen that the handle 15, in conjunction with its pivot point 20 and the cooperative engagement between the locking pin 13 and engaging point on camming surface 14*a*, form a lever arrangement. The mechanical advantage of the lever is defined by the relative lever arm length between the pivot point 20 and the point of application of force by the operator on the upper portion of the handle, and the distance between the point of engagement of locking pin 13 and the cam 14*a* and the pivot point. FIG. 2 illustrates the equipment 10 in fully mounted and locked relationship with the mounting base 11. It is noted that the relationship between the locking pin 13 and the cam surface provides both a holddown and insertion force as regards the equipment 10 and the mounting base 11.

If now one considers that the particular unit 10 of FIG. 2, which is to be mounted on, or fully inserted within, a mounting means 11 has a variation in length along the insertion axis (a variation in equipment depth) different from optimum, the particular relationship of the locking pin and camming surface and handle lock position will vary. Actually, even optimized tolerance as concerns the depths of the equipment to be mounted and the particular dimensions of the mounting base (and thus location of the locking pin 13) may seriously affect the proper insertion/holddown capabilities of the handle.

Accordingly the present invention provides a means of varying the position of the pivot pin 20 on the handle 15 along an axis substantially transverse that of the longitudinal axis of the handle, whereby adjustment may be made for any particular unit/mounting-base pair to optimize the camming, hold down, and locking operations of a particular handle with a given base. Tolerances which are normally expected in any manufacturing operation will then be accommodated. In addition, as will be further described, the movable handle pivot point provides a decided advantage in allowing the operator to control the mechanical advantage of the handle lever so as to optimize the handle for both extraction and insertion operations. A ready means is also provided for applying added force between the locking surface and camping pin after the mechanism is inserted in locked position to assure protection from shock and vibration loads.

With reference to FIG. 1, the handle pivot pin 20 is seen to be carried on a mounting member 25 which is free to translate along through-slot 26 formed through the lower portion of handle 15. The slot axis is essentially transverse of the longitudinal axis of handle 15.

Pin-mounting member 25 is threadedly received on a lead screw 27 and is constrained from rotation with respect to the handle due to its confinement within the slot 26. Rotation of the lead screw 27 by means of knob 16, therefore, causes the pin-mounting member 25 to translate between predefined extreme positions within the slot 26, thus varying the position of the handle pivot pin 20 with respect to the handle.

Pivot pin 20 is rotatably received in mounting bracket through-holes 29 and 30 and thus adjustments of the pivot pin position with respect to the handle 15 adjusts the relationship of the handle and is camming surface with respect to the locking pin 13 which is rigidly affixed to the mounting base 11. Although not shown in detail, it will be appreciated that the lead screw member 27 is mounted with the thrust washers adjacent the handle 15 surfaces and provided with a tension washer and locking nut 28, such that the lead screw 27 is rotatably retained in the handle assembly. The knob 16, by means of which the pivot pin adjustment is made, may be a torque knob, whereupon the knob 16 rotates with respect to the lead screw 27 upon a predetermined torque being imposed by the operator.

The advantages of the variable pivot point may be appreciated by reference to FIG. 3 wherein the lower portion of the handle 15 including the pivot point adjustment and cam lobes is illustrated.

FIG. 3 illustrates the fixed locking pin 13 is locked relationship with respect to the handle camming surface. The handle is formed with a front can lobe 14*a* and a rear cam lobe 14*b*. The hooklike cam arrangement is generally designated by reference numeral 14. The pivot pin 20 is illustrated in a first position 20 and a second position 20' representing the respective extremes of adjustment effected by rotation of the torque knob 16. With the pin in the position designated 20 in FIG. 3, a lever arm of length B is effected between the pin position 20 and the point of engagement between locking pin 13 front cam lobe 14*a*.

With the pivot pin in position 20' a shorter level arm A is effected. Now considering that the operation grasps the upper portion of the handle 15 at a given point, it is seen that the handle assembly, in its cooperative relationship between cam lobe 14*a* and locking pin 13, defines a lever of variable mechanical advantage. With the handle pivot pin at position 20, the B length lever arm between pivot pin and locking pin defines a lever with less mechanical advantage than when the pivot pin is in position 20' with the shorter lever arm length A.

The torque knob 16 provides a convenient accessible adjustment of this mechanical advantage. With the handle pivot point at position 20, the mechanical advantage of the handle is smaller because length B is larger and a predetermined handle movement will cause a proportionally larger increment of equipment notion to the rear than with a pivot pin position at point 20'. Thus the operator may adjust the pivot pin position by means of the torque knob 16 to move the equipment larger increments of distance to the rear with a smaller mechanical advantage at the initial point of insertion and then move the equipment smaller increments of distance to the rear with greater mechanical advantage by adjustment of the pivot point to position 20'. The advantage of this arrangement is that the handle design permits an insertion process such that as equipment nears the maximum engagement to the rear and the loads are greatest, the pivot point is nearest position 20' where the mechanical advantage is greatest. This advantage is illustrated functionally in FIGS. 4 and 5. FIG. 4 illustrates the pivot pin in position 20 to facilitate greater increments of movement of equipment requiring smaller insertion forces since the pivot pin position at point 20 provides a small mechanical advantage. Conversely, FIG. 5 illustrates a pivot pin position at point 20' to facilitate smaller increments of

movement of equipments with larger insertion forces, since a larger mechanical advantage is effected.

It is thus seen that the handle assembly may be advantageously used for mating equipments with large injection forces by moving the handle pivot point to a setting such that the equipment is moved into its aft mated located in several successive "bites " or handle camming actions—that is to say, if the equipment is difficult to inject, the pivot position can be set so that complete closure of the handle assembly moves the equipment one small increment of the total distance required. The handle may then be released and another turn of the pivot point torque knob assembly made, etc. until the complete engagement distance is accomplished. Each movement of the pivot can be as large or small as required and is determined only by how far the torque knob is rotated.

The handle assembly is locked by closing the handle. This closed relationship is illustrated in FIG. 2. As more particularly illustrated in FIG. 6, the handle might be formed with an inclined ramp surface 36 to cooperate with a spring loaded ball member 37 such that during the final few degrees of handle closure, the spring-loading locking pin or ball 37 rides up the inclined ramp 36 and drops into a spherical radius detent 34. With the handle now locked the torque knob 16 may be rotated until a present torque level is reached. When this point is reached, further rotation of the knob will slip the torque knob assembly. The rotation of this torque knob to achieve predetermined torque level after handle locking, allows an additional force to be exerted against the clevis or holddown pin 13 and prevents potentially damaging movement of the equipment due to vibration and shock loading.

The variable mechanical advantage feature of the handle assembly of this invention also provides an advantage in ejecting equipments in much the same manner in which the equipment was injected, except the handle rear cam lobe 14*a* is used and pivot pin position 20 provides the greatest mechanical advantage in that it provides the shorter level arm distance between the pivot pin location and the point of engagement of the locking pin 13 and the cam surface.

After the equipment is ejected form its mounting means 11, the equipment handle 15 rotated into a carrying position by means of a lightly loaded leaf spring 18 (referring to FIGS. 1 and 2). The leaf spring is guided in a spring guide slot 17.

The present invention is thus seen to provide an improved lever latch handle mechanism by means of which the mechanical advantage of the lever mechanism may be advantageously adjusted to facilitate injection and removal of equipments from mounting bases and by means of which a simple, readily accessible, adjustment for variation in tolerances between equipments to be mounted and mounting bases may be effected and, finally, by means which the equipment, once locked in position, is provided an added measure of safety against shock and vibration forces.

Although this invention has been described with respect to a particular embodiment thereof, it is not to be so limited as changes might be made therein which fall within the scope of the invention as defined in the appended claims.

I claim:

1. A cam latching handle mechanism for facilitating translational movement between a first handle carrying member and a second member carrying a locking pin member, said handle comprising arcuate camming lobe means operably engageable in hooklike fashion with said locking pin member, said handle handle carrying a pivot pin extending transverse the direction of said translational movement and received in first pin receiving means fixed to said second member and second receiving means associated with said handle, whereby rotation of said handle member about said pivot pin axis effects a predetermined camming relationship between said handle member and said locking pin member, and adjustment means carried on said handle and in cooperative engagement with said second receiving means for selectively varying the lever arm distance between said handle pivot pin axis and said locking pin member by translating the position of said second pivot pin receiving means along a position axis which is substantially coextensive with the direction of translational movement between said first and second members when the longitudinal axis of said handle is positioned substantially transverse said direction of translational movement.

2. A mechanism as defined in claim 1 wherein said arcuate camming lobe means comprises first and second camming lobes within the confines of which said locking pin member is receivable, each of said camming lobes being selectively positionable into camming relationship with said locking pin member upon rotation of said handle member about said pivot pin, said first and second camming lobes being formed such that rotation of said handle member in a first direction about said pivot pin effects a communicating relationship between a first one of said camming lobes and said locking pin member to translate said first member in a first direction with respect to said second member and rotation of said handle member in an opposite direction about said pivot pin effects a communicating relationship between the second one of said camming lobes and said locking pin member to translate first member in the opposite direction with respect to said second member.

3. A mechanism as defined in claim 1 wherein said pivot pin second receiving means comprises a substantially rectangular block slidably confined in a through-slot formed in said handle member said through slot being coextensive with said pivot pin position axis, a lead screw member received in threaded engagement with said block, the longitudinal axis of said lead screw member being coextensive with said pivot pin position axis and means for selectively rotating said lead screw with respect to said handle member to effect translation of said block along said position axis.

4. A mechanism as defined in claim 3 wherein said means for rotating comprises a torque knob affixed to an operator accessible end of said lead screw member, the application of a predetermined torque to said torque knob effecting slippage between said knob and said lead screw member.

5. A mechanism as defined in claim 1 wherein the face of said camming lobe means is formed with a locking pin engaging surface of arcuate cross section having a predetermined radius, said locking pin member being formed with a decreasing radius from the transverse extremes thereof to the central portion to define a spherical radius less than the radius of said camming lobe means.

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