

Dec. 30, 1947.

J. E. BEVINS

2,433,541

RESETTING MECHANISM FOR INDICATORS

Filed June 12, 1945

4 Sheets-Sheet 1

FIG. 2.

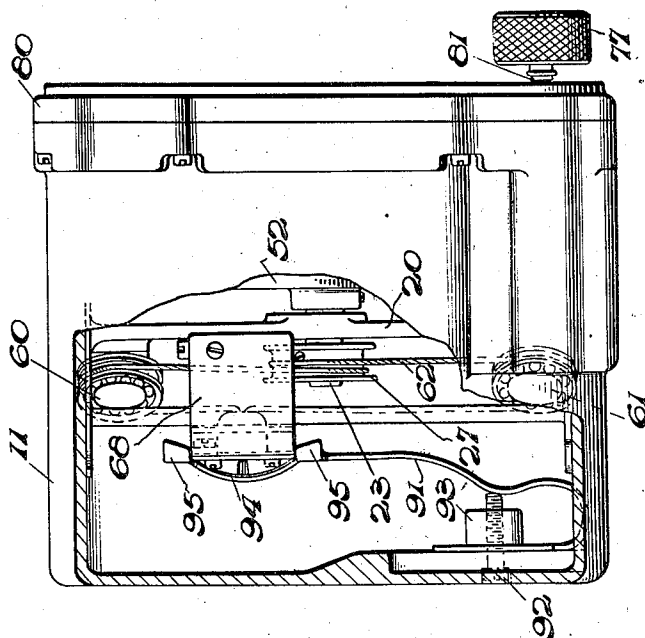
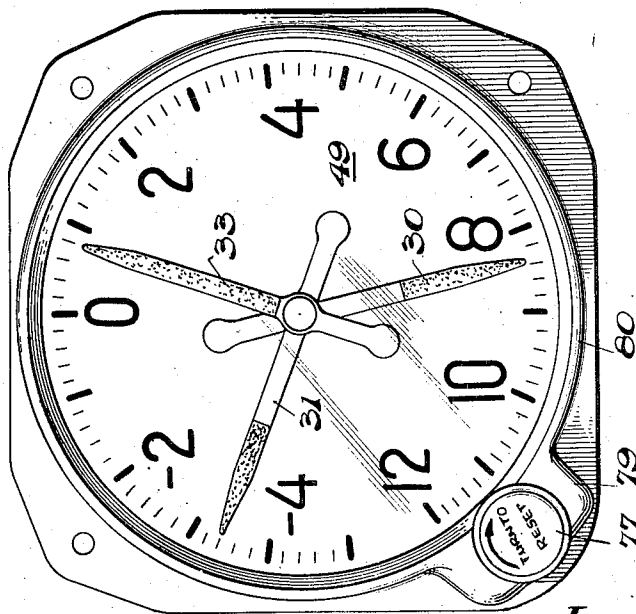


FIG. 1.



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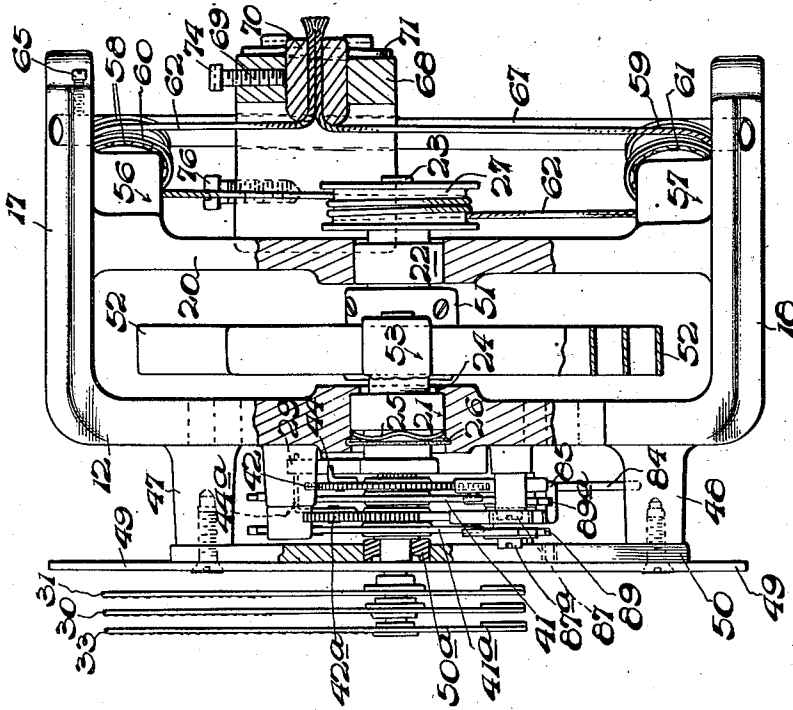


FIG. 3.

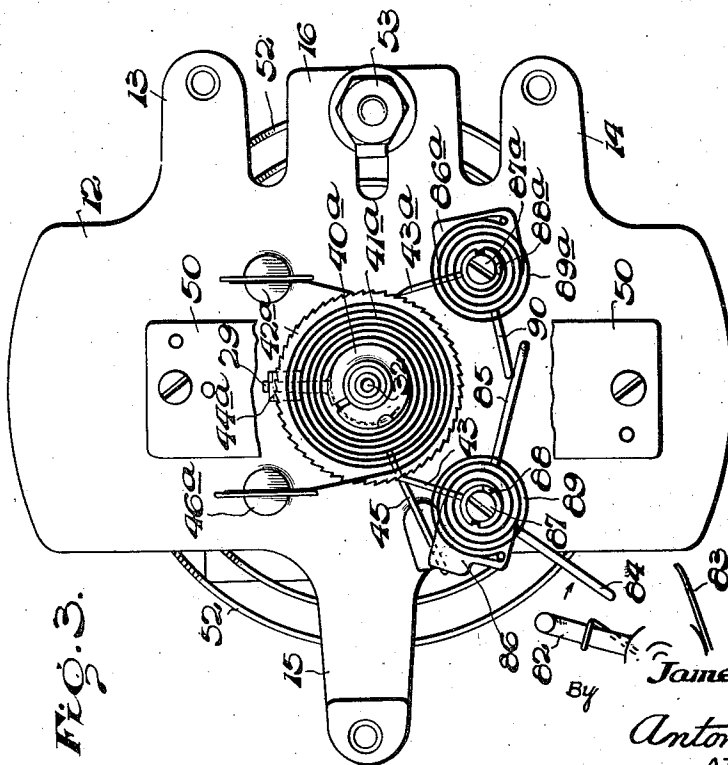


FIG. 4.

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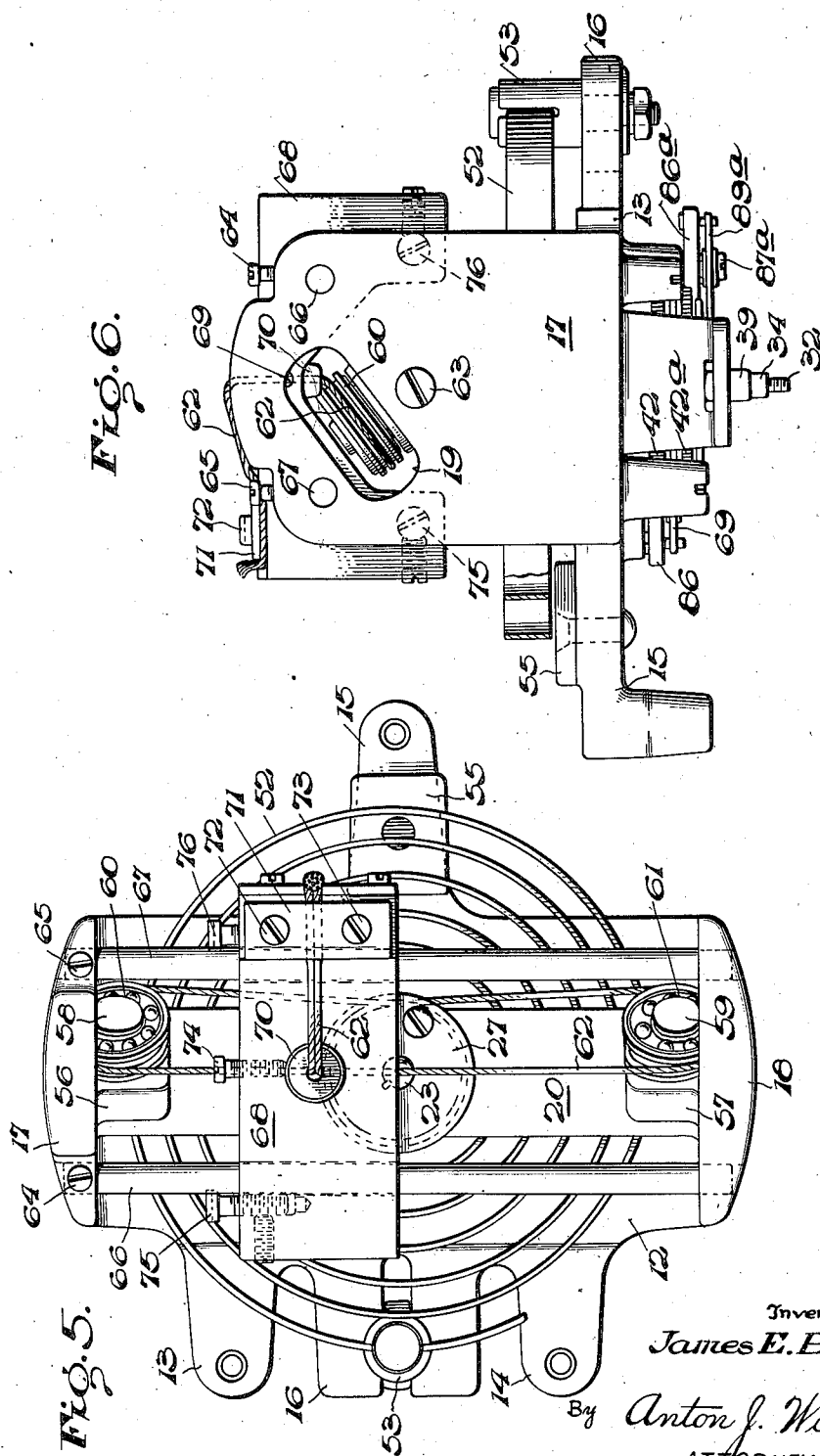
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RESETTING MECHANISM FOR INDICATORS

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4 Sheets-Sheet 3



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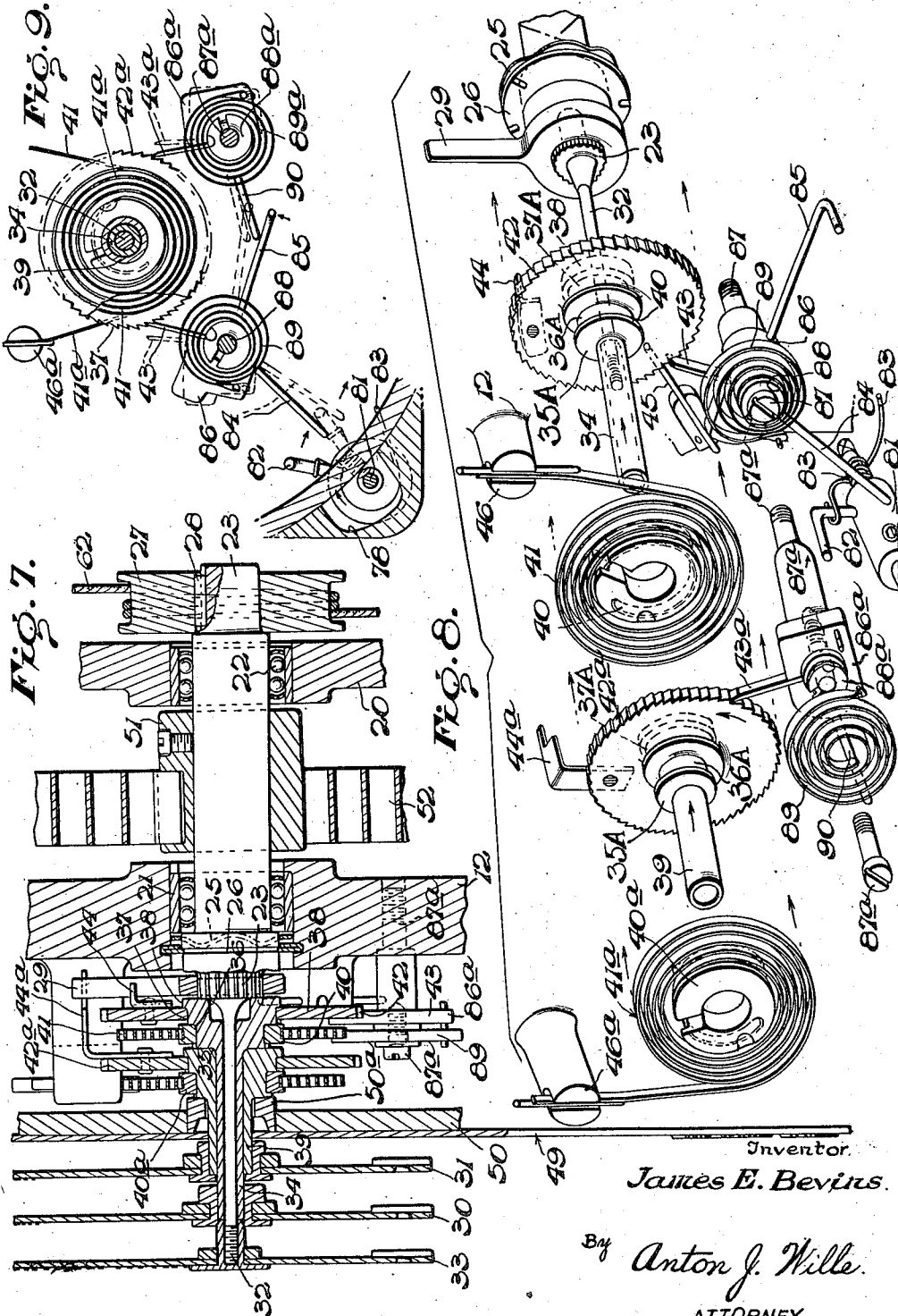
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RESETTING MECHANISM FOR INDICATORS

Filed June 12, 1945

4 Sheets-Sheet 4



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2,433,541

RESETTING MECHANISM FOR INDICATORS

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Original application May 19, 1943, Serial No.
487,673, now Patent No. 2,394,974, dated Feb-
ruary 19, 1946. Divided and this application
June 12, 1945, Serial No. 599,001

15 Claims. (Cl. 116—129)

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This invention relates to resetting mechanisms, and more particularly to a resetting mechanism for an instrument such as an accelerometer, having a plurality of detainable maximum indicator hands or pointers.

This application is a division of my copending application for an accelerometer bearing Serial No. 487,673, and filed on May 19, 1943; now Patent No. 2,394,974, issued Feb. 19, 1946.

An object of the present invention is to provide a resetting mechanism which shall return simultaneously a plurality of detained indicator hands of an instrument to an initial or zero position.

Another object of the present invention is to provide a resetting mechanism of the character described which shall return two unidirectional coaxial pointers rotatable in opposite directions to their respective initial or zero positions.

A further object of the present invention is to provide a highly improved resetting mechanism of the character described which shall be easy to operate, relatively inexpensive to manufacture, positive in action, which shall have a large variety of applications, and yet be practical and efficient to a high degree in use.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists in features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter described, and of which the scope of this application will be indicated in the appended claims.

In the drawings wherein like reference characters refer to like parts throughout the several views:

Figure 1 is a front elevation view of the assembled device.

Figure 2 is a side elevation view partly in section.

Figure 3 is a front elevation view of the frame without the casing.

Figure 4 is a side elevation view partly in cross section.

Figure 5 is a rear elevation view of the frame.

Figure 6 is an elevation view with a fragment of the main spring in cross section.

Figure 7 is an enlarged section view of the device taken along the axis of the main drive shaft.

Figure 8 is an exploded view of the indicator hand assemblies and their respective reset mechanisms.

Figure 9 is a detached view of the reset mechanism partly in elevation and cross section.

Referring to the drawings, in detail, in the

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illustrated embodiment of the invention, the device comprises a casing 11, a frame which may be cast or otherwise formed so as to have a flat plate member 12 from which extends a plurality of lugs, as 13, 14, 15 adapted to secure the frame to the casing, and a slotted lug 16 for the purpose hereinafter described. Two flat outer frame bars 17 and 18 continue from each end of plate 12 substantially perpendicular with respect thereto. The bars 17 and 18 are provided with arcuate outer surfaces to facilitate a complementary fit within the casing 11, shown in Fig. 2. The plate top bar 17 of the frame contains an elongated opening 19 angularly disposed towards the rear edge of the bar for a purpose hereinafter set forth.

Extending between bars 17 and 18 in spaced parallel relation to plate 12 is a flat bar 20. Plate 12 and bar 20 are provided intermediate their ends with axially aligned bearing openings adapted to receive and house bearing members 21 and 22, if desired of ball bearing type, associated with a main driven shaft 23 disposed in the frame parallel to outer frame bars 17 and 18.

The driven shaft 23 is secured against axial thrust by mounting bearing 21 in the bearing opening of plate 12 against annular shoulder 24 and locking the same therein by corrugated washer 25 and split ring 26 adapted to snap into an annular groove in the bore of the bearing opening. The corrugations of washer 25 permit slight axial resiliency, but prohibit any definite axial thrust or movement.

The main driven shaft 23 extends through to the outside flat face of plate 12 and bar 20. The extremity of shaft 23 outside of plate 12 carries an improved pointer or indicator mounting and operating assembly, while the other extremity of the shaft has mounted thereon a drum pulley 27, by any suitable means such as a key 28, in Figure 7.

Specifically referring to Figures 4, 7 and 8, the improved indicator assembly, shaft 23, as it projects from the plate 12, carries a lever 29, splined or otherwise secured, adapted to revolve in either a clockwise or counterclockwise direction to selectively operate the maximum indicator members 30 and 31 through their associated parts. The associated parts for each maximum indicator member coacting with the lever 29 are identical in construction and detailed reference to one set of parts therefore will describe both. Accordingly, leading up to such detailed reference, the shaft 23 has a reduced shaft or extremity 32 continuing from lever 29 to the exposed tip end of which is keyed, or otherwise secured, an instantaneous indicator hand 33. Freely mounted around reduced

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shaft 32 is a tubular shaft or elongated sleeve 34, to the exposed tip end of which is keyed or otherwise secured a maximum indicator hand 30. Tubular shaft 34 has an enlarged stepped annular end adjacent lever 29, so as to provide annular surfaces 35, 36 and 37. The annular surface 37 is provided with an anchoring shoulder 33.

Each of the annular surfaces supports a cooperating part. Elongated annular surface 35 has freely mounted thereon an identically formed tubular shaft 39 of less length than surface 35, so as to expose the end portion of the shaft 34. Surface 36 is associated with a split collar 40, keyed or otherwise secured thereto, collar 40 holding the inner coiled end of winding spring 41. Surface 37 is associated with ratchet wheel or disk 42 in mesh with a pawl 43 and carries a pin or arm 44 near its peripheral edge adapted to be acted upon by lever 29.

Also, in the arc of travel of pin 44 is positioned a stop 45 adapted to prevent rotation of disk 42 beyond a predetermined point.

The spring 41 has its outer coil end anchored in forward projecting split stud 46 mounted on plate 12, so that clockwise rotation transmitted from ratchet wheel 42 winds the spring 41 about split collar 40.

The tubular shaft 39 is provided with similar annular surfaces 35A, 36A and 37A, described in connection with shaft 34, and each annular surface carries a similar corresponding part, as indicated by numerals 40a, 41a, and 42a, in Figure 8. L-shaped pin 44a is adapted to coact similarly to pin 44 with lever 29, but to permit such coaction is made longer and shaped to contact the opposite edge of lever 29.

Extending forwardly from plate 12 are spacer lugs 47 and 48 to which is secured a flat bar 50 and indicating dial 49 traversed by the indicator members 30, 31 and 33 and marked to provide readings in g's (units of gravity) of the positive or negative accelerations being applied along the vertical axis of the airplane carrying the device. The dial 49 has a centrally disposed opening in alignment with a relatively large opening in bar 50 having a bushing 50a secured therein, through which project the ends of the indicator hand shafts previously described. Obviously, the indicator hands are thus in position to turn around the dial to various readings in g's.

Secured between plate 12 and bar 20 to main driven shaft 23 at the inner coil end by a sleeve 51 secured on the shaft is a coil spring 52 and secured at the outer end of the coil by a bolt and split sleeve fastener 53, secured within the elongated slot of lug 16. Spring 52 is so set as to retain the indicator hands and weight normally in a neutral or inoperative position. Lateral displacement of the spring coils is limited by block 55 secured to plate 12 adjacent the peripheral edges of the coils.

Above and below drum pulley 27 and angularly disposed from bar 20 at its point of junction with top and bottom frame bars 17 and 18 are lugs 56 and 57, in each of which are respectively secured pulley axles or shafts 58 and 59.

Pulleys 60 and 61, which may be ball bearing type, are freely mounted on the shafts 58 and 59 for rotation, pulley 60 being visible through angular slot 19 in top bar 17, said slot being sufficiently large to permit shaft 58 and pulley 60 to laterally move into alignment with the slot for adjustment of cable 62 on the pulley upon release of set screw 63. The axes of shafts 58 and 59 are angularly disposed with respect to the plane

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of the axis of the main shaft 23, that carries drum pulley 27 to prevent tangle or slack caused by overlapping cable and provide for a straight non-shearing pull and even coiling of cable 62 around the drum surface of pulley 27.

In the outer end of each bar 17 and 18, secured by set screws 64 and 65, are parallel guide rods 66 and 67, preferably spaced farther apart than the overall diameter of pulley 27 and outer peripheral edges of the pulleys 60 and 61. The proportional spacing of guide rods 66 and 67 with respect to the foregoing elements is important for the proper installation of a mass or weight 68.

The mass or weight 68 is designed to be of maximum avoirdupois for a minimum amount of cubic space. To provide for this the mass is cast or cut out at the side adjacent the cable pulleys in a V-shaped well portion 69 so shaped and so proportioned, as to clear the pulleys 27, 60 and 61 during operation.

Centrally disposed and projecting through the mass or weight 68 to the vertex of well 69 is a bushing 70 through which driving cable 62 is threaded, strung across weight 68 and secured under plate 71, suitably held in place as by screws or bolts 72 and 73 to tether the cable to the weight or mass.

The bushing 70 is held in place by set screw 74. Also, adjustably positioned in each top edge of weight 68 are stop members, such as screws or bolts 75 and 76 adapted to limit upward thrust of the weight by contact with top bar 17.

During operation of the present device the instant hand 33 moves in either direction and returns to neutral or zero position promptly in response to the tension of spring 52 when accelerated vertical impulses cease, but the maximum hands 30 and 31 as they turn in their respective fields wind springs 41 and 41a and are locked in their furthestmost positions by their respective pawl and ratchet mechanisms. Hand 30 being locked by spring pressed pawl 43 engaging ratchet wheel 42 and hand 31 being locked in the same manner by reversely rotating ratchet wheel 42a and spring pressed pawl 43a, whereupon after a specific series of indications are finished the hands 30 and 31 must be released or reset to normal position for the next dive and pull-out.

An arrangement accordingly is provided to simultaneously release both newly mounted pawls 43 and 43a from the teeth of the ratchet wheels to reset the hands. Referring to Figures 1, 3, and 9 the reset or release mechanism comprises a knob 77, a chamber 78 in an enlarged off-set portion 79 in bezel 80 and a shaft 81 projecting through bezel 80 and chamber 78. Bezel 80 is secured to casing 11 in any suitable manner, so that enlarged part 79 lines up with an inwardly extending portion of flange of casing 11 through which extends shaft 81. The shaft 81 has a lug 82 pointing towards the front of the casing secured thereon and normally held inoperative against the wall of chamber 78 by a spring 83. Shaft 81 at this point projects through the flange of casing 11, so that lug 82 extends into the casing between dial 49 and plate 12. Adjacent and within the radial throw of lug 82 is a bell-crank lever with arms 84 and 85 depending from a spring anchor plate 86, which plate is journaled to plate 12 by suitable means, as bolt 87, and a split collar 88 to hold the inner coil end of spring 89 and pawl 43.

Operation

In reference to one feature of operation it should be noted that the maximum indicator

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hands in the present disclosure are directly operated by the lever 29 through a pin 44 carried by one hand operating ratchet disk 42 adapted to rest against one edge of the lever and through an L-shaped pin 44a carried by another maximum hand operating disk 42a adapted to rest against the opposite edge of lever 29.

Spring 39 has its outer coil end anchored to plate 86 and its inner coil end anchored to split collar 88, that carries pawl 43, on bolt 87, so as to normally press the pawl into engagement with ratchet wheel 42. As the ratchet wheel 42 rotates, spring 41 winds up on shaft 34.

Arm 84 is in the line of travel of lever 82 and arm 85 extends across plate 12 into contact with an arm 90 depending from twin spring anchor plate 86a mounted on bolt 87a, which is slightly longer than bolt 87. Split collar 88a, pawl 43a and spring 89a are secured to the plate 86a in the same manner described as in plate 86.

When the pilot puts the plane in which the instrument is mounted into a dive, the weight 68 is acted upon by positive vertical accelerations, so that cable 62 is pulled about pulleys 60, 61 and 27, whereupon main shaft 23 is rotated in a clockwise direction and instantaneous indicator hand 33 carried by reduced shaft 32 is moved to give constant positive readings in units of gravity. Directly following actuation of the instant indicator hand, motion is transmitted through pin 44 to disk 42, whereupon maximum positive indicator hand 30 sweeps forward clockwise about the dial, winds spring 41 around surface 36, and is held set to its foremost position by pawl 43 engaging ratchet disk 42, until the pilot pulls out of the dive; whereupon the instant hand 33 returns past zero point and instantly begins to give negative indications while the maximum indicator hand 30 remains set at such maximum positive indication.

When the pilot comes out of a dive he may go directly into a substantially vertical rise or climb, whereupon the weight 68 moves along guides 66 and 67 in the opposite direction for negative indication, the chain of operation being identical to that just described with the exception that lever 29 moves ratchet disk 42a through L-shaped pin 44a in a reverse direction, so as to actuate maximum hand 31 in a constantly forward counter-clockwise direction, until the pilot levels off.

To reset the maximum indicator hands 30 and 31, knob 77 is rotated, shaft 81 rotates against spring 83 and lever 82 strikes arm 84 and rotates plate 86 against action of spring 39 and releases pawl 43. Simultaneously with this operation arm 85 lifts arm 90 and similarly releases pawl 43a and the maximum hands return to zero under unwinding action of springs 41a and 41.

In Figure 2, is illustrated a weight holder comprising a flat spring 91 having its lower end bifurcated and secured to the back of casing 11 by stud 93, adapted to normally be in a retracted position against the casing wall. The spring 91 is provided at the top with an enlarged claw head 94 and a plurality of lugs 95 adapted to engage around the weight when the spring is forced forward by a set screw 92 passing through the casing 11 and the stud 93 to hold the weight for shipping the device.

To illustrate an advantage of this device, when a dive approaches some predetermined value, the pilot knows it is time to pull out, as during pull-out a gravitational force of from 1 to 12 times normal must be overcome.

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The duration of the acceleration is generally so small that it would be impossible for the pilot to read the instrument during this maneuver and therefore he must read the maximum and minimum hands after the maneuver has been completed. By associating his sensations and actions and readings of airspeed and altitude during the dive with the accelerometer reading when the dive is completed, the pilot can predict and control the acceleration imposed on the aircraft.

Such terrific force increase, not only acts upon the plane and crew, but also upon the instruments in the plane and the elimination of prior art damper structures employing gears and linkages, that break under such extreme gravitational force is a particularly valuable feature of the present invention.

There is thus provided a novel improved and simplified single means for resetting one or more indicator hands or pointers of accelerometers having maximum negative and positive indicator hands or pointers independently responsive to vertical accelerations of an aircraft in diving and climbing, or a dive and pull out, which may be easily and quickly reset manually and simultaneously from the outside of the casing, after indicating or recording such maximum accelerations, so as to effect the return of such hands to zero in connection with mechanism within the casing of the instrument, for reuse.

While only one embodiment of the invention has been illustrated and described, various changes and modifications, which will now appear to those skilled in the art, may be made without departing from the scope of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In combination with a suitable indicator casing, a reset mechanism for indicator hands comprising a manually operated actuator means, a lever on said actuator means adapted to swing in a predetermined arc, a frame in said casing, a plate journaled to said frame, a bell-crank lever associated with said plate having an arm thereof in the line of travel of said first lever, a spring-pressed pawl associated with said plate adapted to engage a ratchet wheel associated with one of said indicator hands, a second similarly mounted plate spaced from said first plate, a spring-pressed pawl associated with said second plate, and a lever depending from the second plate adapted to coact with the other arm of said bell-crank lever, whereby operation of said actuator means swings the lever thereon into engagement with the bell-crank lever on the first plate and swings the bell-crank into contact with the lever depending from said second plate to thereby simultaneously release said pawls.

2. Means adapted to simultaneously reset a plurality of indicator pointers in combination with a suitable casing and a frame therein, comprising manual actuating means outside the casing adapted to extend to operative position within the casing, a pair of spaced plate members swivelly mounted in the frame, a spring locked pawl mounted on each plate, a bell-crank lever associated with one of said plates and said actuating means, and a single lever extending from the other plate over a part of said bell-crank lever, whereby movement of said operating means rocks the bell-crank and lifts said single lever to simultaneously release said pawls and reset the indicator pointers.

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3. In combination with a suitable indicator casing having a plurality of indicator hands, a resetting mechanism comprising a manually operated actuator means, a lever on said actuator means adapted to swing in a predetermined arc, a lever in the line of travel of said first lever, releasable holding means associated with each of said indicator hands, a third lever adapted to rotate with the second lever, and a fourth lever associated with said holding means, the operation of the actuator means swings the lever thereon into engagement with the second lever to swing the third lever into engagement with the fourth lever to thereby simultaneously release said holding means.

4. A reset mechanism for indicator hands comprising a manually operated actuator means, a lever on said actuator means adapted to swing in an arc, a bell-crank lever having an arm thereof in the line of travel of said first lever, releasable holding means associated with the bell-crank lever and each of the indicator hands, and a third lever adapted to coact with the other arm of said bell-crank lever, whereby actuation of the actuator means swings the lever thereon into engagement with the bell-crank lever and swings the latter lever into engagement with the third lever to thereby simultaneously release said holding means.

5. A reset mechanism for indicator hands comprising a manually operated actuator means, a lever on said actuator means adapted to swing in an arc, a bell-crank lever having an arm thereof in the line of travel of said first lever, releasable holding means associated with the bell-crank lever and each of the indicator hands, a third lever adapted to coact with the other arm of said bell-crank lever, whereby actuation of the actuator means swings the lever thereon into engagement with the bell-crank lever and swings the bell-crank lever into engagement with the third lever to thereby simultaneously release said holding means, and means to return said hands to normal positions upon release of the holding means.

6. A reset mechanism for indicator hands comprising the combination with a casing, actuator means, a lever on said actuator means rotatable thereby, a frame in the casing, a bell-crank lever journaled in the frame and having an arm thereof in the line of travel of the first lever, spring-pressed holding means associated with the bell-crank lever and each of the indicator hands, a lever having a spring-pressed holding means associated therewith and adapted to coact with the other arm of said bell-crank lever whereby operation of the actuator means swings the lever thereon into engagement with the bell-crank lever and swings the bell-crank lever into engagement with the third lever to thereby release said holding means, and spring means normally holding the hands in zero position and operable upon release of the holding means.

7. A reset mechanism for indicator hands comprising actuator means, a lever on said actuator means adapted to swing in a predetermined arc, a casing, a frame in the casing, a plate journaled in the frame, a bell-crank lever associated with said plate and having an arm thereof in the line of travel of said first lever, spring means normally holding the indicator hands in zero positions, a spring-pressed holding means associated with the plate and one of the indicator hands, a second similarly mounted plate spaced from the first plate, a spring-pressed holding means associated with the second plate, and a lever extend-

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ing from the second plate adapted to coact with the other arm of said bell-crank lever whereby operation of said actuator means swings the lever thereon into engagement with the bell-crank lever associated with the first plate and into contact with the lever extending from the second plate to simultaneously release said spring-pressed holding means.

8. Means adapted to simultaneously reset a plurality of indicator hands normally held at zero, comprising the combination with a casing and a frame therein, actuating means outside the casing extending into the casing in operative position, a pair of spaced members mounted to swivel in the frame, spring holding means on each member, a lever associated with one of said members and said actuating means, and a lever extending from the other member and over an arm on the first lever whereby movement of said actuating means rocks the first lever and moves said second lever to simultaneously release said spring holding means whereby the indicator hands return to zero.

9. A reset mechanism comprising, two movable members, and biasing means for each of said members for returning said members to their respective initial positions, a detent for each of said members to hold said members in their furthestmost positions to which they are moved, a movable reset member, a third member adapted to be moved upon movement of said reset member to release one of said detents, and a fourth member adapted to be moved by movement of said third member to release the other of said detents, the release of said detents permitting said biasing means to return said first and second members to their respective initial positions.

10. A reset mechanism comprising, two movable members, and biasing means for each of said members for returning said members to their respective initial positions, a detent for each of said members to hold said members in their furthestmost positions to which they are moved, a movable reset member, a third member adapted to be moved upon movement of said reset member to release one of said detents, a fourth member adapted to be moved by movement of said third member to release the other of said detents, the release of said detents permitting said biasing means to return said first and second members to their respective initial positions, and biasing means for said reset member, said third member and said fourth member to return their respective members to an initial position upon release of said reset member.

11. A reset mechanism comprising, two rotatable members, and biasing means for each of said members for returning said members to their initial positions, a spring biased detent for each of said members to hold said members in their rotated positions, a rotatable reset member, a third rotatable member adapted to be rotated by the rotation of said reset member to release one of said detents, and a fourth rotatable member adapted to be rotated by the rotation of said third rotatable member to release the other of said detents, the release of said detents permitting said biasing means to return said first and second members to their respective initial positions.

12. A reset mechanism comprising, two rotatable members, and biasing means for each of said members for returning said members to their initial positions, a spring biased detent for each of said members to hold said members in their ro-

tated positions, a rotatable reset member, a third rotatable member adapted to be rotated by the rotation of said reset member to release one of said detents, a fourth rotatable member adapted to be rotated by the rotation of said third rotatable member to release the other of said detents, the release of said detents permitting said biasing means to return said first and second members to their respective initial positions, and resilient means for said reset member, said third member and said fourth member for returning said members to their initial positions upon release of said reset member.

13. A reset mechanism comprising, two rotatable members adapted to be rotated in opposite directions, biasing means for each of said rotatable members for returning their respective members to an initial position, a spring biased detent for each of said members biased in a direction opposite to that in which its associated member is rotated to hold said members in their rotated positions, a reset member adapted to be rotated, a third member adapted to be rotated by the rotation of said reset member in a direction which is opposite to the bias of one of said detents to release said detent, and a fourth rotatable member adapted to be rotated by the rotation of said third member in a direction opposite to said third member to release the other of said detents, the release of said detents permitting said biasing means to return said first and second members to their respective initial positions.

14. A reset mechanism comprising, two rotatable members adapted to be rotated in opposite directions, biasing means for each of said rotatable members for returning their respective members to an initial position, a spring biased detent for each of said members biased in a direction opposite to that in which its associated member is rotated to hold said members in their rotated

positions, a reset member adapted to be rotated, a third member adapted to be rotated by the rotation of said reset member in a direction which is opposite to the bias of one of said detents to release said detent, a fourth rotatable member adapted to be rotated by the rotation of said third member in a direction opposite to said third member to release the other of said detents, the release of said detents permitting said biasing means to return said first and second members to their respective initial positions, and resilient means for said reset member, said third member and said fourth member for returning said members to their initial positions upon release of said reset member.

15. A reset mechanism comprising, two coaxial shafts rotatable in directions opposite to each other, a return spring for each of said shafts, a detent for each of said shafts to hold said shafts in the positions to which they are rotated, a manually operable reset member, and means rotatable upon actuation of said reset member to release both of said detents to permit the simultaneous return of both of said coaxial shafts under the influence of their respective return springs to their initial positions.

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