

J. I. MITCHELL ET AL
NAVIGATIONAL DEVICE AND REVERSIBLE COUNTER
DRIVING MECHANISM THEREFOR

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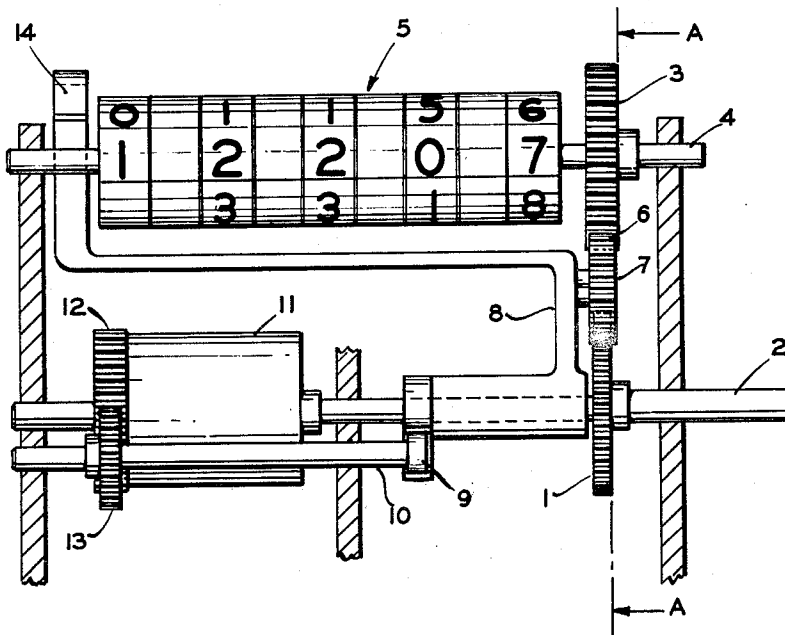


FIG. 1

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July 16, 1963

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3,097,793

Filed April 3, 1962

2 Sheets-Sheet 2

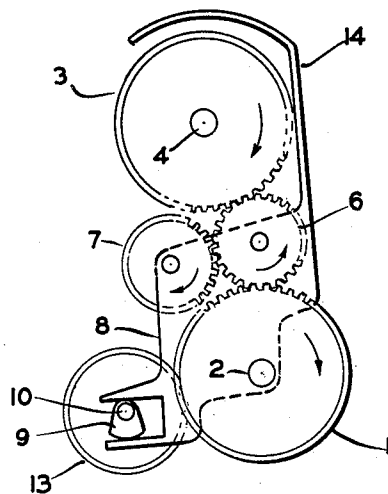


FIG. 2

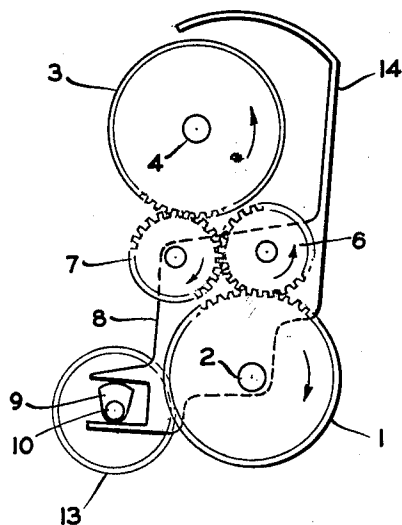


FIG. 3

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NAVIGATIONAL DEVICE AND REVERSIBLE COUNTER DRIVING MECHANISM THEREFOR

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Filed Apr. 3, 1962, Ser. No. 184,767

8 Claims. (Cl. 235-132)

This invention relates to a navigational device and to reversible counter driving mechanisms therefor, and more particularly to such mechanisms for latitude or longitude counters.

In navigation counters for providing indications of latitude or longitude such as those used aboard aircraft, need exists for a counter wherein the indication reverses after a predetermined number of drive shaft revolutions. Such counter permits use of one set of counter wheels in situations where the counter must indicate both additions and subtractions. For example, in a longitude indicating counter for navigation purposes, the counter must add from 0°00' to 180°00', and then subtract to 0°00' again. If rotation is continued, it must again add, and repeat.

Therefore, one object of this invention is to provide a counter having simplified means for reversing its direction of indication after a predetermined number of drive shaft revolutions.

Another object of this invention is to provide a counter having a reversing mechanism which enables the counter to be positively driven.

Another object of this invention is to provide a counter having a reversing mechanism in which the driven gear is never completely disengaged from the driving mechanism.

Another object of this invention is to provide a navigation counter for indicating both additions and subtractions, requiring only one set of counter wheels.

The invention contemplates a reversing mechanism for driving a navigational counter in the forward or reverse directions. The mechanism comprises a driving gear, a pair of transfer gears one of which is meshed with both the driving gear and the other transfer gear, and means for positioning the transfer gears so that one or the other transfer gear drives the driven gear, which in turn drives the digital counter through an output shaft. The means for positioning the transfer gears is dependent upon the number of revolutions made by the driving gear, and permits the counter to reach a maximum indication and then count back to zero with continued rotation of the driving gear.

In the drawings:

FIGURE 1 represents a front cutaway view of the counter and reversing mechanism shown in the forward counting position.

FIGURE 2 represents a sectional view on the line A—A of FIGURE 1 when the apparatus is in the forward counting position.

FIGURE 3 represents a sectional view on the line A—A of FIGURE 1 when the apparatus is in the reverse counting position.

Referring now to FIGURE 1 of the drawings, a driving gear 1 is shown mounted on and drivingly engaged to an input shaft 2. A driven gear 3 is shown mounted on an output shaft 4, which in turn drives a counter shown generally as 5. The driven gear 3 is driven through a pair of transfer gears 6 and 7, which are mounted on a movable arm 8. This arm is pivoted about the input shaft 2, and can be moved to either of two extreme positions by a cam 9. This cam, which is in slidable contact with arm 8, is mounted on a shaft 10 and is drivingly engaged to an intermittent gearing group 11 through a pair of driving

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gears 12 and 13 which are in mesh with each other. The gearing group 11 is driven by the input shaft 2.

FIGURE 2 more clearly shows the arrangement of pivoted arm 8 and transfer gears 6 and 7 in driving the counter in the forward direction, while FIGURE 3 shows the same arrangement for driving a counter in the reverse direction.

In operation, input shaft 2 is driven in one rotational direction only (assume this to be clockwise) so long as the craft on which the counter is mounted travels in one general direction only. Driving gear 1, being connected to shaft 2, is thus driven in the clockwise direction also. Transfer gear 6 which is constantly in mesh with driving gear 1 is thus driven counter-clockwise, and transfer gear 7 which is constantly in mesh with transfer gear 6 is driven clockwise. The driven gear 3 meshes with either transfer gear 6 or 7, depending upon the position of the pivoted arm 8 and is drivingly engaged to the output shaft 4. The position of pivoted arm 8 depends upon the rotational position of the cam 9. Cam 9 is positioned by shaft 10 which is driven from the intermittent gearing group 11 through the meshing gears 12 and 13. The intermittent gearing group 11 is driven by the input shaft 2.

The intermittent gearing group 11 may comprise any of the well known devices which produces a rotational output after a certain number of predetermined input rotations has occurred. At the proper time, for example when the counter has reached 180°00' longitude, the last transfer on the intermittent gearing group drives gear 13 through 90° rotation. At that time cam 9 moves the pivoted arm 8 so that gear 3 becomes unmeshed with gear 6 and meshed with gear 7 thereby rotating the driven gear or counter wheel 3 in the opposite direction. The counter indication is now reduced with continued clockwise rotation of the input shaft. The arrangement and timing of gears 6, 7 and 3 is such that gear 3 is never unmeshed from both gears 6 and 7 at the same time. Thus there is no loss in synchronism. As input shaft 2 continues to rotate, counter 5 will continue to rotate in the reverse direction and intermittent gear group 11 will be rotated in accordance with the input shaft. At 90°00' longitude gear 13 is rotated again. Cam 9 rotates with gear 13, but due to the shape of the cam the pivoted arm 8 does not change position. At 00°00' longitude cam 9 is again rotated, and at this time it moves the pivoted arm 8, putting the appropriate transfer gear 6 in mesh with gear 3, again reversing rotation of the counters. Continued rotation of shaft 2 causes the cam to move again at 90°00' longitude without actuating the pivoted arm, and at 180°00' longitude the action again repeats.

It should be noted that the operation described could be accomplished by moving cam 9, or an eccentric only at 180°00' and 0°00', but the gear ratio and torque required are reduced if the cam is operated four times instead of two. It should also be noted that the input shaft 2 can be operated in either rotational direction with the same sequence of operation.

When the invention is applied to a longitude counter a shutter or flag 14 may be attached to the pivoted arm 8 and adjustably positioned thereby for indicating an east and west longitude condition. Similarly, the invention may be applied to a latitude counter and the shutter or flag 14 may be attached to the pivot arm 8 and adjustably positioned thereby to indicate a north and south latitude condition. The invention may also be applied to a variation counter or other counters which have to reverse their direction after a predetermined number of shaft revolutions.

The invention provides a positively driven counter having means for reversing its directional indication after a predetermined number of drive shaft revolutions. The

reversing mechanism is such that the driving gear is never completely disengaged from the driven gear. Furthermore, the navigation counter provided by the invention requires only one set of counter wheels.

Although but one embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes can be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

What is claimed is:

1. A reversing mechanism having an input shaft, a first gear drivingly engaged by the input shaft, a second gear meshed with the first gear, a third gear meshed with the second gear, a pivoted arm mounting the second and third gears, a cam slidably contacting the pivoted arm for positioning the arm in either of two positions, means for moving the cam in accordance with the number of input shaft revolutions, and a driven gear for driving an output shaft meshed with the third gear when the arm is in one position and meshed with the second gear when the arm is in the other position.

2. A reversing mechanism having an input shaft, a driving gear mounted on and driven by the input shaft, a first transfer gear constantly in mesh with the driving gear, a second transfer gear constantly in mesh with the first transfer gear, a pivoted arm mounting the transfer gears, a cam slidably contacting the pivoted arm for positioning the arm in either of two positions, means for rotating the cam in accordance with the number of input shaft revolutions, an output shaft, and a driven gear drivingly engaged to the output shaft and meshing with the second transfer gear when the arm is in one position, and meshing with the first transfer gear when the arm is in the other position.

3. A reversing mechanism having an input shaft, a driving gear mounted on and driven by the input shaft, a first transfer gear constantly in mesh with the driving gear, a second transfer gear constantly in mesh with the first transfer gear, a pivoted arm mounting the transfer gears and adapted to be positioned in either of two positions, a cam slidably contacting the pivoted arm for positioning the arm, an intermittent gearing group driven by the input shaft and drivingly engaged to the cam, an output shaft, and a driven gear drivingly engaged to the output shaft and meshing with the second transfer gear when the arm is in one position, and meshing with the first transfer gear when the arm is in the other position.

4. A reversing mechanism having an input shaft, a driving gear mounted on and driven by the input shaft, a first transfer gear meshing with the driving gear, a second transfer gear meshing with the first transfer gear, a movable arm mounting the first and second transfer gears and adapted to be positioned in more than one position, means slidably contacting the movable arm for position-

ing the arm, an intermittent gearing group driven by the input shaft and drivingly engaged to said means, an output shaft, and a driven gear drivingly engaged to the output shaft and meshing with the second transfer gear when the arm is in one position and meshing with the first transfer gear when the arm is in a second position.

5. A navigational device comprising a counter, a reversing mechanism for driving the counter, said reversing mechanism including an input shaft, a driving gear connected to and driven by the input shaft, a pair of transfer gears, one of the transfer gears meshing with the driving gear and the other transfer gear, means for selectively positioning the transfer gears in a first position under one operative condition and in a second position under another operative condition, and a driven gear for driving an output shaft operatively connected to the counter, said driven gear meshing with one of the transfer gears when the positioning means is in a position to selectively position the transfer gears to said first position, and said driven gear meshing with the other transfer gear when the positioning means is in another position to selectively position the transfer gears to said second position.

6. The combination defined by claim 5 including means operatively connected to said positioning means for indicating the prevailing operative condition.

7. A navigational device comprising a geographical degree counter, a reversing mechanism for driving the counter, said reversing mechanism including an input shaft, a driving gear connected to and driven by the input shaft, a pair of transfer gears, one of the transfer gears meshing with the driving gear and the other transfer gear, a movable arm mounting the transfer gears and adapted to be positioned in one position under a first condition of operation and in another position under a second condition of operation, means slidably contacting the movable arm for positioning the arm, an intermittent gearing group driven by the input shaft and drivingly engaged to said positioning means, an output shaft, and a driven gear drivingly engaged to the output shaft and meshing with one transfer gear when the arm is in said one position and meshing with the other transfer gear when the arm is in said second position.

8. The combination defined by claim 7 including means operatively connected to said movable arm for indicating the first and second conditions of operation.

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